Science Communication Without Frontiers

11th International Conference on Public Communication of Science & Technology

December 06-10, 2010; New Delhi, India

National Council for Science & Technology Communication

International Network on Public Communication of Science & Technology

Indian Science Communication Society

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Preface

Science communication is important especially to the public in the form of an attractive and consumable product at times when they need it the most. At the same time, the public involvement and engagement with science communication practices may offer a multilateral diffusion of such knowledge that empowers people with the ability to take not only informed but also analytical and rational decisions to overcome day-to-day problems. S&T communication is attributed to interactive process of exchange of information and opinions amongst individuals, groups, and institutions.

I am delighted to say that NCSTC has been able to put together a large canvas of programmes and activities in different parts of the country and has been able to arouse millions of science enthusiasts to bridge science-society gap.

As the 'information age' rapidly progresses and if we want to direct it towards 'knowledge age', we need to develop the potential at foundation level to foster and support appropriate synergistic and imaginative combinations of groups to promote science-public interactions for the common cause of public understanding of science.

Public communication of science and technology is an important activity as scientific research. Public need to be kept abreast of the latest developments with pace of generation of knowledge. There is definite order in understanding science and its changing paradigms.

I am sure, the deliberation made during the conference would be of very high standard and be immensely useful for the furtherance and advancement of the area of science communication.

I must put on record my appreciation for the untiring efforts put in by the National Organizing Committee lead by my colleague Dr. Manoj K. Patairiya and for his professionalism, team spirit, meticulous approach and quality concern in terms of turning the 11th PCST-2010 into a reality. I am happy to welcome members of PCSTC Scientific Committee, Organizing Committee, Sub Committees, and Chairs, Co-Chairs and Coordinators of different sessions.

I am happy to note that delegates from all across the world including young students and researchers are adding colours and academic value to the programme.

My best wishes for a grand success of the Conference.

(Dr. Kamal Kant Dwivedi)
Chair, International Advisory Committee, 11th PCST-2010
Adviser & Head
National Council for Science & Technology Communication
Dept. of Science & Technology, Govt. of India
New Delhi-110016, India

Foreword

I am delighted to welcome you to the 11th International Conference of the Network for the Public Communication of Science and Technology.

This is only the second major conference we have held in Asia, and it is fitting that it takes place in India. India, of course, has a proud record of scientific advancement and discovery over thousands of years.

The PCST Network held its first conference in Poitiers in France, in 1989. It was organised by a group of scholars and practitioners from France and Spain who found that none of the existing conferences matched their subject of science communication.

Since then the PCST Network has grown and expanded into a truly international organisation. These conferences allow practitioners and theoreticians to come together to consider some of the most important questions: the best way to advance community discussions and understanding of science issues.

Science can solve many problems and open new opportunities, but the community has to be comfortable with the solutions it proposes and the methods it recommends. The community needs information and it also needs for its voice to be heard. The role of science communication is to enable this exchange of ideas, in a way which allows criticism as well as a new understanding.

In recent years, science communication has gained new recognition, with journals of science communication, universities conducting research and training in science communication, and a job market developing for science communicators. The area of teaching, research and practice is emerging as a field of study in its own right.

I congratulate and thank the Indian Government, the sponsoring bodies and the local organisers for their vision in bidding to host the conference and their hard work in making it happen.

The PCST Scientific Committee knew that the Indian conference would be a different and special experience, and we have leaned much from working with the local organisers.

We look forward to a memorable conference.

(Toss Gascoigne)
President
PCST Network
Canberra, Australia

Introduction

Welcome to 11th PCST-2010 in India, the land of Gandhi and Geeta, the land of sacrifices and enlightenment, the land of gods and spiritual fulfillment, and the land of knowledge and wisdom. India has a very rich tradition of communication, especially when it comes to communicating to masses. Folk arts, like Nautanki, Ramlila, folk songs and folk dances are immensely effective as the means of mass communication. Ramlila is one of the oldest of folk arts, possibly, which has communicated to millions and millions of people over generations, the code of conduct and ideals of social life.

Lord Gautam Budha had given a doctrine of communicating knowledge c400 BC, which says,

"…Do not believe on whatever you are told or you yourself have imagined it, unless you testify it. Do not believe whatever your teacher says just because you respect him, but believe only after your own examination and analysis; it would be your guiding factor that will never let you down. Even do not believe on whatever I say, unless you have tested it with due experimentation as a goldsmith does for testing of gold by putting it in fire…!"

More recently, Mahatma Gandhi was possibly the greatest communicator of all times, who aroused people of India to participate in the freedom struggle with their might against the mightiest empire the world had ever seen, and all this was through his extraordinary communication skills, which was so natural to him. "..... Every cultural pattern and every single act of social behaviors involve communication, in either an explicit or implicit sense. "Sappier (1931) had probably underlined the might of mass communication, which is the root cause of any social change, let alone development.

This speaks volumes of the impact of sustained communication, in changing the way a society thinks and behaves, unmistakably the only perceivable panacea for innumerous miseries of people the world over. India has a great tradition and a treasure of scientific heritage. Various classical works were carried out in Indian subcontinent, in the fields of mathematics, astronomy, medicine, material science, and so on during ancient, medieval and modern periods, which still form a huge treasure of cultural heritage. Medieval age, however, saw a remarkable phenomenon. Classically coded literature was made comparatively simpler and written in the popular forms of commentaries and analyses. One can observe a tradition of such commentators in the country, who contributed such secondary knowledge literature for generations. Many of ancient works, be it 'Aryabhatiya' of Aryabhat or 'Leelavati' of Bhaskar, are available in these forms.

The first Prime Minister of India, Pandit Jawahar Lal Nehru introduced the concept of modern scientific temper to the world. Accordingly the Constitution of India has special provision "to develop the scientific temper, humanism and the spirit of enquiry and reform" as one of the "Fundamental Duties" mentioned under Part IV A, Article 51 A
(h).

Here is a glimpse of current communication challenges and we are meeting these challenges with a mixed media approach, including, print, broadcast, folk, digital, and interactive:

- Languages : 22 Regional languages
- 100+ dialects

- Communicating with different regions
- Common thread of communication
- 33 States
- 4 Union Territories, 1 National Capital Region
- 602 Districts
- 4 Casts/ 6 Religions/ 1000+ Clans
- Food Habits : 64,000 recorded food recipes
- Diverse Culture
- Media : TV 97, Radio 100, Print 7, Digital 0.30%
- 150 recorded so-called miracles

Public Communication of Science & Technology (PCST) is important for the economic and social wellbeing of society and for the exercise of participatory democracy. It implies the ability to respond to technical issues and problems that pervade our daily lives. It does not mean detailed knowledge of scientific principles, phenomena or technologies, but rather an appreciation of the way science works and how the community can interact with science to help shape its work. New technologies and new media can trigger and sustain public interest in S&T, allowing a dialogue to developing and preparing the people for change.

The 11th International Conference on Public Communication of Science & Technology will deliberate on both practical and theoretical aspects of science communication, in a globalised world with major inequalities and development challenges. The conference is a platform for all delegates, science communication practitioners, analysts, teachers and students for their exchanging experiences on their efforts towards addressing different aspects and perspectives on science-based issues of today and tomorrow.

India, one of the most emerging economies of the world, is uniquely positioned to host a discussion on the role of science in modern society. Poised between modern and developing nations, India represents the future, a world where everything is under challenge including the old frontiers.

The aim of 11th PCST-2010 is to consider new ways of thinking about science communication, and new ways of putting the best ideas into practice, models, tools, policy matters and social factors involved in public communication of science and technology. I am sure, the conference will provide an opportunity for the presentation and open discussion of all kinds of ideas, experiences and works related to science communication, popularisation and science literacy.

It is refreshing to learn that scientists and science communication researchers from across the world will be participating in strategic talks at the conference aimed at addressing issues and policies intended at dissemination and linking scientific research to common public and finding ways and means to enhance the abysmally low level of science literacy amongst masses in the world.

The large canvas of the conference is also evident from its spread over three phases, i.e. at Khajuraho, Delhi and Jaipur. The Pre Conference Seminar held at Khajuraho from December 04 to December 05. The Main Session of the Conference is taking place in New Delhi from December till December 09 and the Post Conference Session will be held at Jaipur during December 10-11, 2010. This conference is being held for the first time in India and for the second time in Asia. The major outcome of the conference amongst others, would be “New Delhi Declaration 2010 on Science Communication” which is to be adapted at the closing ceremony of the conference, which can pave the way for furthering the subject of science communication across the world. It’ll also guide us towards the future course of action in chalking out coordinated efforts in achieving the of “Science Communication Without Frontiers”, which is also the focal theme for 11th PCST-2010.

This conference is also an endeavor to bring under one roof experts in science popularization from different countries, like the USA, the UK, Germany, France and other European countries, China, Korea, Japan and other Asian countries, African nations, South American countries, India and many more. The purpose is to exchange the newer ideas evolved in various parts of the country, so as to benefit the science communicators in their task of helping the common man not only understand science and technology, but also understand the workings of the various gadgets of modern science and technology that are in use today.

There is also a lot to learn from socio-economically diverse cultures from India and work together for international cooperation with different nations to strengthen efforts in science communication to serve the mankind better. Many relevant questions important to the different socio-economic conditions prevailing in certain countries will be raised and solutions found to handle them, so as to enable them to be free from the clutches of ignorance and superstition, and see light–scientific light.

This 11th International Conference of Public Communication of Science and Technology is a cauldron in which after deliberations of seven days will emerge gems of synthesized knowledge that will benefit the popular science movement across the world to stem the tide of ignorance in knowledge of science and technology and take this caravan forward and help create a scientific global citizenship.

Science popularization is no longer confined to the black and white of books and newspapers. Today it is done by using the radio, TV, by organizing interviews, plays, puppet shows, cartoons, audio-visual science films, etc to entice even the uninterested common man. The technology to spread the message of science and technology has become so complicated and involved that a whole genera of experts have evolved, having enormous levels of competencies in different fields. Science communication has emerged as a new field of expertise, a new profession to practice.

11th PCST-2010 is a step forward in accelerating this movement. On behalf of the Organizing Committee, I welcome all the delegates who have come all the way from different parts of the world covering all continents, 50 countries, over 500 delegates, including 200 international experts belonging to various specialized groups, i.e. scientists, technologists, science policy makers, science administrators, science communicators, journalists, researchers, educationists, teachers, and students, who'll be presenting over 400 research papers, review papers, case studies, survey analysis, 24 workshops, exhibits, 10 activity corners, and talks, etc. I thank with great sense of gratitude to one and all, who have contributed to the organization of the conference, especially the Government of India, M.P. State Council of Science & Technology, Indian Science Communication Society, Vaigyanik Drishtikon Society, International Centre for Science Communication, Indian Science Writers' Association, and Indian journal of Science Communication. I also extend our sincere thanks to International Network on Public Communication of Science & Technology (PCST-Netwotk) for giving us opportunity for hosting 11th PCST-2010 conference in India. I wish a comfortable stay to all delegates and hope to have a thought provoking and fruitful conference.

(Manoj K. Patairiya)
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I

A Critical Review of Science Communication in the World

1. Agenda Setting Process in China's Science Popularization Policy: A Case Study of the National Action Scheme for All Citizen's Scientific Literacy

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Abstract. Science popularization policy (SPP) is a key instrument to promote public communication of science and technology, and to improve citizens' scientific literacy. Since 1990s, Chinese Central Government has issued three top level SPP, i.e., "Opinions on reinforcing science popularization" in 1994, "Law of science popularization" in 2002, and "Outline of national action scheme for all citizens' scientific literacy" in 2006, which constitute three milestones in the development of China's SPP system.

Our research questions are: (1) how the agenda of the SPP were set? (2) Which model of agenda-setting in the public policy field could be applied to analyze the Chinese cases of SPP agenda setting? (3) Is the model of agenda-setting testified, modified or falsified in the Chinese context of SPP? (4) What are the Characteristics of and Challenges for SPP agenda-setting? The authors get relevant data from several sources. (1) Primary literature on the SPP documents; (2) accounts of the SPP published by the policymakers and experts involved in the policy process; (3) articles published by researchers; (4) interviews with several important SPP policymakers.

We choose in our analysis the John W. Kingdon's Multi-Stream Model of agenda setting, which is widely used as an analytical framework for general public policy studies. The Kindon Model maintains that the three independent streams, i.e., problem stream, policy stream, and politics stream together create the windows of opportunity, and result in the agenda setting. The authors make detailed case studies of agenda setting process in the three milestone SPPs mentioned above. In this paper we present the case study of the SPP "National Action Scheme for All Citizen's Scientific Literacy".

We analyze the three streams as follows: The problem stream: (1) The bi-annual surveys of national citizens' scientific literacy (SL), which started in China in 1992, revealed that average level Chinese SL was too much lower than that in the developed countries, which was believed to be a major hindrance to the modernization of China; (2) The FLG incidents occurred in 1999. It was reflected that one of the major reasons was low level of citizens' SL including particularly lack of scientific spirit.

The policy stream: The USA Project 2061 which aims to improve the SL for all American in 76 years, the cycle of the Halley Comet, was introduced into China in 1998 after the top leadership of the China Association of S&T (CAST) participating the 150 years anniversary of the AAAS. The leadership underwent policy learning, forming the idea of long term plan, the Project 2049, similar to the Project 2061. CAST also sought legitimation for the project proposal from the national development strategy, and from the Chinese Communist Party's documents. CAST sent the project proposal to the CCPCC and State Council in 1999; however CAST did not get the official replies from the Central Government till 2002. During this period, supported by CAST, the books concerning the Project 2061 had been translated and published in China.

Political Stream: during 2000- 2001, the key newspaper of the CCP and the Government such as the Peoples Daily published many articles, urging for improving the national SL. The top leaders of the CCP and state councils also delivered talks about SL. The vice Premier in charge of national Science and education held a meeting about science popularization in Nov 2001, and a participant from science popularization community mentioned that CAST did not get the relies to the project proposal on SL from the State Council. The vice Premier asked to check the issue as soon as possible and in February 2002 the State Council agreed CAST together with other ministries jointly to make the policy. The agenda was finally and officially set.

The authors think the Kindon Model is appropriate to analyze complex agenda setting process. However, three streams were not independent as Kindon Model assumed, rather they were connected and interacted in the Chinese context. Thus, we modify the Kindon Model as: The problem stream, policy stream and political stream interact and contribute together to the agenda setting. We also find that there are different policy cultures in the SPP agenda setting and policy making in China. The four cultures (political, economical, scientific, and civic) interact, cooperate and compete in the agenda setting and policy making process.

2. A Manifesto for Re-information: Re-scripting Intellectual Property through Ewriting Theories and Practices

Artur Matuck
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Abstract. Ewriting (electronic writing) generates theories, practices and computer applications that evolve and continuously redefine our perspective on writing. Ewriting tools will challenge deep-rooted cultural habits at the base of our language and thought processes. In a foreseeable scenario, writing would proceed through networking so that every word sequence, every newly conceived phrase would immediately reverberate through net bases, causing responses in diverse formats. As planetary net-integration evolves, ewriting processes will make so much use of data structures that invention will normally be thought of as and realized through re-invention or co-invention. However, legal theories and legislations ingrained in almost unchangeable statutes restrain emerging collaborative authorship models and practices. But if the vision of writing as a socio-machinist planet-wide process prevails, current intellectual property values and legal theories will need to readapt.

Keywords: Authorial processes, ewriting, authors' rights; intellectual property, re-information

3. On the Social Responsibility of Science Popularization

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Abstract. This paper debates that science popularization has its own important responsibility for local society and global community, as well as for the whole humanity and lives in the earth. Science communicators should deliberately choose appropriate contents and approaches to communicate science and technology knowledge that base on the evaluation and value judgment. As for that purpose, the author further argued that communicators should have an evaluative thinking in the process of science communicating. He also elaborates the important role that evaluation has played in perfecting the practical programs theories, building the scientific outlook on development under the new historical conditions. The author holds that evaluative thinking parallel with critical thinking is one of the most useful ways to guarantee a better play of the role of science and technology communication in serving our society while we confront many global problems.

Keywords: Social Responsibility, Science Communication, Evaluative Thinking, Environment of Assessment

4. Lazy Expertise vs. Lay Expertise: The Construction and Bias of **China's Health Knowledge**

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Abstract. China has dedicated itself for the health knowledge popularization for years. But the top-down diffusion of knowledge mode by means of professional expertise seemed to get limited performance. On the contrary, the public are disposed to give all their trust to the lay expertise.

5. Science, Emotion and Objectivity

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Abstract. Is scientific literacy helpful for the objectivity of thought? Human thinking is very important for almost everything in human life. However, what I think is not always right! Our thinking is not healthy, nor good enough in many cases. It is easily twisted and contaminated by many factors. One of them is human emotion that is not properly controlled, but rather prompts us to react to people, events and situations, before trying to think. How can we solve this problem or make progress in human thinking in the right direction?

In our daily life we see a lot of violence, but we don't even recognize it as violence. We are prone to perceive it as honest expression of opinions. Furthermore these days human emotion gets a lot of attention and importance. However, the order in the process of thinking is important since emotion is to be responsive, not to think and lead. If we are controlled by our feeling without thinking we will make a lot of messes in our lives. Even when we face something that prompts us to react emotionally we have to be able to stop to think first and then respond. We have to learn how to think and respond properly. For that, we need to be objective in seeing things.

In science, we try to find a hidden logic and sometimes this requires our intelligence and patience. We wait and think, trying to find a "why?", and understand the reason behind things. Here our mind is objective, not subjective. This is a good thing about science study and education. We can learn objectivity from science. And we can form an objective attitude without being emotional more than necessary in the course of studying science. I see many people say they are rational and fair in their thinking and they really seem to believe themselves to be that way. But when they have to make a decision or express their opinion toward a controversial issue in society, they easily become emotional and their opinion is affected by their feeling relating to their former experiences or personal benefits, and they make a decision that is not rational, nor objective but very subjective and biased by personal experiences. Many cases that become violent and disruptive have an inception that is emotional. Emotion has a lot of energy, so it needs to be controlled properly. And one of the best ways to steer emotion is the objectivity of thinking. Where can we obtain the objectivity of our thinking and how is it possible to make this good habit our new nature?

Science can be a good teacher for us to learn how to be objective in thinking. Natural phenomenon shows us some truth that we approach with a sound mind and patience to figure out what is hidden. In this process we use our mind in a way that is objective. The motion of the sun, the moon and other planets reveals their faithfulness to not change their patterns haphazardly, but follow certain rules continuously. This is just one simple example. There are numerous things that are logical and orderly, so we can learn wisdom and a fair mind from natural science. Science makes us think intelligently, deeply and patiently. Through its training we can develop our thinking ability and how to be emotional properly. Then we can be protected from a lot of emotional violence.

Scientific literacy should affect people to be objective, intellectually honest, and morally right.

6. African Science Heroes

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Abstract. African Science Heroes, a poster, film, and biographical narrative on the triumphs of African scientists, serves two primary purposes: to empower budding young African scientists by describing innovative possibilities that can be achieved in any walk of life and to document the legacies of African scientists. This presentation will describe the development of the book, film, and posters for African Science Heroes and the engagement and response from African students. African Science Heroes was the product of a fellowship at the Centre of African Studies, University of Cambridge, on the Public Understanding of Science in Africa.

The lack of recognized, publicized African science role models negatively impacts on the ambitions of young Africans and has serious implications for their self esteem. This project celebrates and demonstrates what can be achieved regardless of economic hardship, war, gender discrimination, and racism. It has ensured a space in history where nothing currently exists that pulls together tales of remarkable African scientific accomplishments. It challenges the stereotypical image of Africa as a continent of hunger, disease, war and poverty. These stories of success have motivated young scholars by providing pioneering science role models. The films and posters have been shared with audiences in the Malawi, Kenya, and the UK.

The collection celebrates the remarkable achievement of 15 African scientists (11 men and 4 women). The scientists featured are from varying disciplines - from nuclear physics and nanotechnology to immunology and computer engineering. They all originate from Sub Saharan Africa with a majority of them living and working in Africa. They were been identified through peers, awards lists and science periodicals. The common thread in these stories is triumph over adversity.

African Science Heroes stand for triumph over adversity and the personal values of sustained hard work, extraordinary imagination, and unfaltering dedication.

7. Involving Experts and Citizens on Climate Change Debate.

The European Project Accent

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Abstract. Climate change issues are clearly a growing concern for the public today. In recent years, people have received a great deal of information from media on the causes and consequences of climate changes, but– depending on countries and regions–the understanding of citizens and their engagement in these topics is still varied. Communication professionals are making effort to communicate the messages correctly. This presentation proposes to contribute to a global effort to develop news tools and actions on climate change from “informative” to the “active” procedures through the exchange and dissemination of practices that involve citizens in actions and dialogue.

In my talk I will start taking into consideration some recent data on European public opinion. Secondly, I will introduce the Accent project (http://www.i-do-climate.eu/), an initiative promoted by a group of 12 European science centers proposing “active procedures” of involvement on the issues of climate change. The science centers are using “active procedures”: hand-on exhibitions, participative games, local citizens forums and many others, in order to engage effectively the public in such themes.

The central point in this presentation is the promotion of two-ways communication channels between the scientific community and the public. Specific attention will be given to the participation of scientists and the role of science centers in the development of communication tools and programs for the choice of scientific topics and for correct and clear information to the non-expert public.

8. Science and Technology Communication through Community Radio

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Abstract. Radio has always been a powerful medium of Communication in India. By late 20th century, even before the advent of private and commercial radio channels, All India Radio had a reach of about 80% of the Indian masses. Listenership was somewhere between 40 % and 50 %. Now even after the advent of so many radio channels, the listenership of radio has increased only marginally. The reason varies from increase in population to advent of television, satellites, internet and other means of communication. However radio communication stands alone, since it may be the only means of communication in difficult times like power failure due to cyclones, earthquakes and other similar disasters.

Community radio catering to the needs of a few lakhs of listeners in the coverage area, can be of great help considering the regional, linguistic, religious and socio economic divides in a vast country like India. Reaching the unreached community, radio can also help in communicating scientific and technological advances to the underprivileged. Moreover by its very nature, participatory programmes can be arranged, since community radio can reach listeners in their own language, address their immediate local problems and suggest solutions. Education is spreading it wings everywhere and the real benefit of education will accrue only when day to day scientific and technological advances are brought to the knowledge of the people and their rights and privileges are understood by them. Community radio can be very effective because of the familiar language, easy reach, participatory nature and effective interaction.

In this connection, the experience of Kongu Community Radio or rather its achievements in science communication to rural people will be an eye-opener. Right from its inception six years ago, Kongu Community Radio has been incorporating scientific and technical programmes for the benefit of the listeners. A daily programme supported and catalysed by RVPSP division of DST, Govt. of India, "Science for Women's Health and Nutrition" addressed the health problems and disseminated valuable information to the listeners, and ran for over one year. Another project supported by the same agency entitled "Understanding Planet Earth" has been running for more than 6 months enlightening the listeners the origin, glory and the threats to the Mother Earth. Not to be left behind in understanding the technological advances a series of 8 episodes on "Chandrayaan" was launched from the day on which the vehicle landed on the moon.

The episodes highlighted the evolution of rocketry, satellites, moon and space probes and the Indian spectacle of Chandrayaan explaining in simple language the nuances of space probe and space technology. Further, programmes on most important scientific discoveries through the ages are broadcast in lucid and simple style for the benefit of even illiterate listeners. Apart from this, awareness programmes on health, nutrition, pollution, global warming etc. are conducted and broadcast in suitable radio format for the benefit of school children and other listeners.

The Science Communication can cut across frontiers and reach the society effectively through Community Radio broadcasts.

Keywords: Community radio, Science communication, Participatory broadcasts

Introduction

All findings, inventions, innovations and achievements of science and technology have to be essentially directed towards the well being of the global society. With the entire world becoming a global village, the thrust areas of scientific and technological research is rightly becoming increasingly focussed towards the well being of the human race. Until the later part of twentieth century, most of the nations have been concentrating on protecting themselves from external threats and defence look the centre stage in their economy and expenditure. The scene has changed now, with most of the countries realizing the need for global cooperation and global protection. Any scientific or technological progress has to have its underlying focus on global issues for achieving this goal. Not only Nations, but individuals, groups, educational institutions, village, town and city administrations and governments also will have to make collective efforts in proper anticipation, planning and execution. The developing countries like India, are focussing their attention on how science and technology can address global issues like natural disasters, global warming, energy conservation, new and renewable forms of energy, nuclear cooperation, space exploration among others. It is the inherent duty of everyone from ordinary citizen to top government executive to ensure that any local issue also will have to be tackled keeping in mind the global repercussions. The saying “Think globally and act locally” has to be the watch word for everyone.

Today, the so called “Fourth Estate” does not denote print and press media alone. Technological advancements in TV, Radio and other electronic media including internet, mostly due to satellite communications, also come under the umbrella of Fourth Estate.

Community Radio (CR)

Radio has always been a powerful medium of communication in India. By late 20th century, even before the advent of private and commercial radio channels, All India Radio had a reach of about 80% of the Indian masses. Listenership was somewhere between 40 % and 50 %. Now even after the advent of so many radio channels, the listenership of radio has increased only marginally. The reason varies from increase in population to advent of television, satellites, internet and other means of communication. However radio communication stands alone, since it may be the only means of communication in difficult times like power failure due to cyclones, earthquakes and other similar disasters.

Community radio catering to the needs of a few lakhs of listeners in the coverage area, can be of great help considering the regional, linguistic, religious and socio-economic divides in a vast country like India. Reaching the unreached community, radio can also help in communicating scientific and technological advances to the underprivileged. Moreover by its very nature, participatory programmes can be arranged, since community radio can reach listeners in their own language, address their immediate local problems and suggest solutions. Education is spreading it wings everywhere and the real benefit of education will accrue only when day to day scientific and technological advances are brought to the knowledge of the people and their rights and privileges are understood by them. Community radio can be very effective because of the familiar language, easy reach, participatory nature and effective interaction.

CR in India

Community radio in India is a relatively new entry in the field of communication. Through the ultimate aim of establishing several thousands of CR stations has not yet been achieved, to-day there are only a little less than 100 community radio stations in India. This has to be compared with more than 6000 community radios even in less populated countries. The reasons are multifold, but some of them are worth mentioning. The fierce competition for setting up profitable commercial radio stations, the hesitation on the part of stake holders in investing on a not too attractive venture in terms of revenue investment, fear of the sustainability, fear of adherence to the policy rules and regulations for CR in India, lack of awareness on CR and its usefulness are some of the major inhibitions forestalling increase in the number of CR stations. But it can be gainsaid that quite a few community radio stations in India are living up to the expectations of the Government of India.

The first Prime Minister of India, Pandit Jawaharlal Nehru wanted Indian citizens to develop what he termed as “Scientific Temper”. Ever since Independence, Science and technology has shown a steady growth, though the impact has not reached million of people in the country and it is imperative that effective communication is necessary to carry forward the message of science and technology to their own place of living since most of them have little opportunity to go elsewhere and get information. In this respect CR stations can play a vital role in effectively communicating information regarding science and technology. Though this may not be the only or primary function of a CR station, it can serve the purpose at the grass-root level reaching the under-informed.

Impact of CR Stations in Tamilnadu

Among the Community Radio stations on air in India, Tamilnadu tops the list with more than 18 stations. In fact the first CR in India started its broadcast way back in 2004 at Anna University, Chennai followed in Tamilnadu by Kongu Community Radio at Kongu Engineering College, at Perundurai near Erode. Anna Community radio started its scientific broadcasts targeting women’s health and nutrition which went on air daily for 1 year with the support of RVPSP division of DST, Govt. of India. The broadcasts brought together women of the coverage area and experts in the field of women’s health and hygiene and Anna CR has now embarked on the second phase of the same programme.

Kongu Community Radio, functioning from Kongu Engineering College situated in a village in real rural surroundings, also look up a project on “Science for Women’s Health and Nutrition” again with support from RVPSP division of DST. The programmes saw participation of women in capacity building workshops, content development, awareness programmes, with guidance and advice from experts in the field. The programme which ran for 1 year successfully has helped to build a strong listeners' base for community radio. The station is now broadcasting a series of episodes on "Understanding Planet Earth" again with RVPSP support. It has helped listeners to understand several aspects of earth, right from its evolution, upto the present day state of the earth. These programmes have been successful in creating awareness on the dangers and disasters facing the earth and the possible ways of combating natural and man-made disasters. All these programmes saw active participation of variety of people mostly women from all walks of life.

Another community radio operating from PSG College of Technology, Coimbatore for the past 3 years has also made impressive progress. PSG Community Radio, through situated in an industry-heavy urban area has been playing a major role in disseminating vital information on community health, global warming and other socially relevant programmes. Currently PSG CR has launched its "Understanding Planet Earth" programme with the guidance and assistance from RVPSP division of DST, Govt. of India.

CR from Holy Cross College, Trichirappalli has also been involved in broadcasting socially relevant programmes which have become popular among their target group of listeners. There are quite a few other community radio stations in Tamilnadu which are providing the science and technology inputs required for their respective catchment areas. In this way the community radios have been playing a major role in disseminating scientific information needed for the particular section of the society in their coverage areas.

Organizations like Commonwealth Educational Media centre for Asia have been providing yeomen service by educating, monitoring and evaluating the performance of CR Stations. It will not be out of place to mention here that realizing the unavoidable expansion of community radio stations in India, the Indira Gandhi National Open University (IGNOU) has launched some courses on "Community Radio". Community radio has also entered the curriculum of Rajiv Gandhi National Institute for Youth Development (RGNIYD) in all their post graduate programmes with a few credits. This Institute also runs Ilanthalir Community Radio from its campus for youth development. Surely, the concept of CR is taking roots in India.

Kongu CR and Science Communication

Apart from DST supported programmes on Science for Women's Health & Nutrition and Understanding Planet Earth, coming back to the efforts taken by Kongu Community Radio in popularizing science and technology, mention has to be made of a few of its programmes. A programme on science and technology popularization called Arivial Paarvai (Scientific Vision) is being broadcast every Sunday for the past 4 years regularly, touching upon the various aspects of science and technology. A series of 8 episodes on India's prestigious space probe "Chandrayaan" was broadcast from the day on which the Moon Impact Probe of Chandrayaan landed on the moon. These episodes highlighted the advances in space probe by different nations of the world, the need for such explorations and finally the aim and achievements of the Indian space venture "Chandrayaan". Based on these episodes, a book entitled "Science Reaching the sky: Chandrayaan" was released. The copies of the book were distributed at World Classical Tamil Conference held at Coimbatore in June 2010 to the delegates who attended the session in which the Project Director of Chandrayaan Mr. Mayilsamy Annadurai delivered a lecture. In an ongoing programme, most important scientific discoveries right from the days of Archimedes are being broadcast every week to enable listeners to appreciate the significance of important scientific discoveries in all fields. More than a hundred discoveries will be highlighted in this series. Efforts are on for bringing out a compilation of all these episodes in the form of a book.

Awareness Programmes

Apart from this broadcasting activity, Kongu Community Radio has been in the forefront in organizing awareness programmes for school children and villagers, on health, nutrition, eye and dental care, HIV AIDS, climate change and global warming. The station crews of Kongu CR have been consistently engaged in taking the message of science to the masses directly, by arranging special programmes and lectures for school children and others. In this aspect, about 3000 school children and 300 teachers have benefited by Kongu CR's outreach programmes on climate change and global warming. All India Radio's Kodaikkanal FM radio, the most popular radio channel in Tamilnadu went on air with exclusive live phone-in programmes on "Global Warming and Climate Change" one of which had the station-in-charge of Kongu CR as its expert presenter. Kongu CR has provided inputs on science and technology to the television channels also highlighting scientific advancements, global warming, natural disasters among other things. Radio professionals from BBC, AIR, Doordarshan, China Radio Tamil Service and dignitaries from USA, Korea, China, Canada, apart from officials, educationists and enthusiasts from all over India, have visited the studios of Kongu CR and appreciated its efforts in enlightening the community.

Kongu CR also has trained radio professionals and media persons. With the assistance of Chennai wing of Internews Network, a 7-day workshop on “Emerging issues in HIV testing” for radio professionals in Tamilnadu was held at Kongu CR station. Another programme on “Role of Media in Earthwise Living” was organized for local media professionals and reporters. Nature walk by school students was successfully organized to inculcate love of nature in young minds. Video clippings, posters and handouts emphasizing the need to protect the beauty and nature of earth were profusely used to create awareness on energy saving and global warming. Many of the programmes emphasized the ways in which the problems should be addressed and tackled. Feedback and responses received and surveys conducted have shown appreciation for these programmes.

Conclusion

Community radio stations can definitely help in taking the concepts of science and technology to the common man and can involve them directly because it is the only channel through which one to one correspondence can be established. The only constraint today is the inadequacy of number of CR stations in India. When more CR stations are established and if each CR station broadcasts at least 20 % of its programmes for popularization and communication of advances in health, science, technology and agriculture, it should be possible to effectively transmit useful information to listeners throughout the country. If every willing citizen is able to participate in well organized programmes, community radios can effectively cut across barriers, reach the people from nook and corner and communicate advances in science and technology in all relevant fields like education, agriculture, environment and energy.

Acknowledgements

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9. Reporting Science and Technology in Print and Electronic Media

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Abstract. The advancement in communication technology has made a huge growth in media industry and also has given a freedom to set new professional trends. The convergence is apparent in many different ways. Media is growing and flourishing but with this growth many questions are emerging on the credibility of its content and the journalistic norms which print and electronic media are inheriting.

A free market provides opportunities for growth, freedom and confidence to explore new things. Media is not only a great source of information but it also gives us a platform to raise our voice. It is a fourth pillar of the democracy which has the power to ask questions. Media can set new trends by making people as well informed citizens at the same time media has the power to influence public understanding on subjects like science and technology.

Today the world is going through major changes. In such circumstances people should be aware and equipped with knowledge and information which leads them in the direction of self-reliance. Media is the source through which people not only know about the happenings of the world but it also gives them a direction to find solutions of their day-to-day problems.

To get the answers of all these questions, the researcher has done a study of print and electronic media for her PhD with topic “Reporting Science and Technology Communication in print and Electronic Media”. It was a content analysis of two mainstream newspapers and Four TV channels.

One of the most important findings of the study was people are very much interested in reading and watching science and technology news/ programs but they are not satisfied with the quantity of coverage being given by TV channels and newspapers to science and technology.

The survey of the school kids, college students and professionals shows that they want a channel devoted to science and technology - based news and programs. They want to see what is happening at world level in the field of science and technology but they are not getting that kind of information from media. It was found in the study that national news channels hardly cover science and technology in news shows.

Channels like Discovery and National Geographic Channels, which show higher percentage of science and technology programs have more information on scientific development around the world but the content of the programs does not match with viewers/ readers requirement for national news.

It is interesting to note that the coverage of science and technology in print media improved over the years, now they are not only giving more space but also publishing special issues on science and technology, it is found in the study that now local news and news from Indian source get more coverage in national newspapers, they are focusing more on positive news stories in comparison to controversial news of science and technology, they also try to explain the subject from scientific point of view and gives more focus to research findings new developments and researches. Media should focus on science and technology news and programs with other categories of news and programs. By including science and technology news in their regular chunk media can help in fostering the scientific attitude and behavior as well as interest towards science and technology.

10. An assessment of lessons learned in the communication and dissemination of emerging scientific issues to environmental policymakers across Europe

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Abstract. In most developed countries today it is generally agreed that for environmental policy to be effective, the decision-making and actors involved need to be well informed by science. However, communication between science and policy has sometimes been ineffective in the past. The ambition to improve the use of science in policy making processes has much in common with the ambition to increase public participation: to limit inadequately informed and incompletely deliberated decisions, which can result in unnecessary costs, social conflicts and mistrust of the government. Previous research has described how the main barriers to successful science-policy communication relate largely to the nature of environmental science, the nature of policy making, and the gap between them. A number of recommendations for addressing this gap have been described in the literature, which have broadly focused upon: increasing interface between scientists and policymakers; use of translators, advocates and networks; and new skills, tools and roles for scientists.

This research tested the value of these recommendations in real-world policymaking settings from a number of European countries, and set out to develop lessons to improve future activities to communicate science to policymakers. Through a series of five in-depth case studies and four mini-case studies, including climate change and nanotechnology, from different countries across Europe, narratives of the communication issues and recommendations from the literature sources were developed. These were then added to and refined through interviews with the key stakeholders involved and then analyzed to isolate themes and patterns. The findings generated a complex picture of the many factors that affect the ways in which science and research feeds into policy making. Some of these factors echoed the criteria identified in the literature, while others were new and additional. Some factors relate to communication, but a number (and arguably the most significant) relate to wider matters – such as the process by which policy is made and the context within which this process takes place. In particular, the research found that the role of the translator is much more complex than simply explaining science clearly and that the credibility of science was key but easily confused by policymakers with the 'settledness' of science. The importance of moving towards an ongoing dialogue model of policymaking rather than an 'end of pipe' model was also identified as being key, with institutional structures, as much as communication players, enabling this ongoing communication to take place. Finally, we consider what these findings mean for communicating research to the public and whether their role would change in this new dialogue model of policymaking.

11. Science Popularization of Grass-root NPO

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Abstract. Research on science popularization organization mostly focuses on social organization and NPO with apparent government background, however, discussion on science popularization of grass-root NPO is rare. This paper briefly analyzed the shortcomings of grass-root NPO in the field of science popularization and the reason of being ignored, and proposed some suggestions.

Keywords: Grass-root NPO, science popularization.

Introduction

With the human society entered high-tech period in the 21st century, the rapid development of science and technology not only provides prerequisite for promoting human welfare, but also makes human beings facing severe challenges. Global warming, resources exhaustion, energy crisis and population boom still are obstacles that crossing in the further development of human beings, a single scientist or any country could not cope with them in way of dealing with these comprehensive problems, which needs globally public engagement. However, the prerequisite of public engagement is to promote the scientific literacy of the public, and to make the public fully understand and recognize these problems. How to let them fully understand the urgent problems and at the same time making the public enjoy the benefit of science and technology achievements? The author thought that the broad science and technology practitioners should throw themselves into science popularization to promote the science literacy of the public.

Just as the name implies, science popularization is the activity which takes promotion the scientific literacy of the public as its purpose, is the process of disseminating scientific and technological knowledge and skills which has already being mastered by human beings and science thoughts, science method, science spirit which evolves from scientific practice to every aspects of the society by various ways and channels. From this perspective, science popularization is a social public welfare and also is the system engineering. During the process of promoting the cause of science popularization, association of science and technology, which is the mass organization of China science and technology practitioners, is the important social sectors of promoting science and technology cause by the government. The broad science and technology practitioners who affiliate to the association of science and technology exert great functions in promoting China science popularization causes. However, science popularization is a systematic work involving every sector of the society. To enhance the science popularization work and promote the scientific literacy of the public is an important and basic social engineering, is the necessary content of socialist material civilization, socialist spiritual civilization and socialist political civilization, which is the collective responsibility of our society. Therefore, the overall engagement is the important component part of science popularization work.

The relevant provision of Law of the Peoples Republic of China on Popularization of Science and Technology regulates that State organ, armed forces, public organizations, enterprises and institutions, rural grassroots organizations and other organizations shall work for PST(Popularization of Science and Technology—note by the author). In order to achieve the working mode of Great Mass Organization-Great Coordination-Great Publicity-Great Science Popularization under the guideline of great unity and coordination requires us to integrate various social resources; thus, we should discuss the function of the grass-root non-profit organization, as a sector of other social organization, in the cause of science popularization.

According to different research perspective, different scholars and researchers give non-profit organization (NPO) different definitions. The author believed that NPO is the social organization between government and enterprises that founded according to voluntary principles but not be founded by business purpose to provide various services to the public or exceptive clients. However, NPO in China has its own features due to its dual-management system; the classification of NPO in China also is extraordinary. This paper will not focus on its classification, but pays much attention to the function and strategies of NPO in developing the science popularization and how to enhance NPOs' effectiveness during the cause of science popularization. Wu Zhongze believed that scientific and technological NPOs are mainly formed by scholarly communities of a specific subject, such as various societies. The practical situation is that these societies belong to the scope of social organization, but not including the grass-root NPO.

The Status Quo of Grass-root NPO in Science Popularization

Recent years, national innovation system has already on the agenda of our government, yet as the important component part of this system, the science and technology popularization system bears the important mission of transforming science and technology into practical productivity. In order to reflect the situation of China science popularization and propose suggestions to China science popularization development, since Oct, 2010, China Research Institute for Science Popularization has already being compiled China Science Popularization Report. The relevant charters of the report would introduce the organizations that carried out science population, these organizations in nature belonged to the scope of NPOs, but which had far more government background. This situation reflects that the grass-root NPOs do not attract enough attention in the process of science popularization. The deficiency of grass-root NPOs in science popularization and their lagging research have its intrinsic reason, but also have extrinsic obstacles. Capital scarcity is the first obstacle of science popularization. According to statistics, there are 191 national societies affiliated to China Association of Science and Technology (CAST), 167 of them are collective membership, which including 41 science societies, 64 engineering science societies, 14 agricultural societies, 22 medical societies, 26 science popularization and interdisciplinary societies. The capital of these societies has a certain guarantee, if we look at to grass-root NPO, their resources of capital is single, most of their capital comes from solicit contributions, donation and foundations. China does not have perfective taxation incentive policy which makes enterprises and individuals would not like to donate, and this further results in a vicious circle of capital deficiency. Taking Beijing Huiling as an example, its capital mostly comes from the grant of foreign foundations. At the same time, its daily maintenance expenditure is very strained.

Shortage of talents results in the inability to make further advances of grass-root NPOs in science popularization. The characteristic of pure public welfare and non-profit making leads them could not attract and retain outstanding human resource through high compensation. The scientific and technological talents with high academic background are inclined to enter enterprises or government departments, which bring about the human resources of grass-root NPOs are marginalized, therefore, they are very difficult to find excellent talents from the personal market. Voluntary group is the indispensable part of providing service of science popularization by grass-root NPOs, however, after careful research, we could find this group could fall into two parts, the first part is students, most of them are being organized by school mass organizations, which brings some difficulties in training and talents cultivation because of their great fluidity; the second part is the successful individuals in other aspects, they get involved in NPOs cause without any expectation of money, but they only could help grass-root NPOs during their leisure time, which means they could not fully take part in the cause. Personnel problem is another obstacle of the development of grass-root NPOs in science popularization.

The narrow scope of grass-root NPOs in science popularization also limits their function. Science popularization system is a comprehensive one, and different science and technology needs different technical talents, however, NPOs could not get the fully human resources that they needs, which results in their limited filed and narrow scope of carrying out science popularization. Most grass-root NPOs have to confine their activities to the much comprehensive but less sophisticated field, for example, they focus their filed on the environmental protection, agricultural industry and sustainable development.

The dual-management system also confines the grass-root NPOs' engagement of science popularization activities. The dual-management system was established by the State Council in 1989, in order to manage the civil organizations. According to this system, any civil organization which wants to take form must find a administrated departments, only after being approved by the administrated departments, can it registers in the civil administration department. This system gives us two hints. The first one is that there are two departments in charging of the registration process, and the approval of the first department is the prerequisite of the second department's approval; the second one is even an organization get approval by the two departments, they still are responsible for different aspects of the organization operation. Therefore, many grass-root NPOs could not find the registration department and subordinated departments, they have to fluctuate between legal and illegal. This also becomes the barrier.

However, the increasing grown number of grass-root NPOs in China like mushrooms after rain shows extraordinary performance in the aspect of science popularization, especially after the Wenchuan Earthquake, a batch of grass-roots NPOs initiatively left for disaster areas, they providing excellent service in assisting the local government in the field of healing the wounded and rescuing the dying. The international society had named the 2008 as China's First Year of Volunteer, which illustrated that the great number of grass-root NPOs had already become an indispensable part of science popularization in China.

When analyzing the science popularization (communication) experience of NPO in developed countries, we could find that purely relying on government could not reach the anticipated results, only giving play to the large-scope characteristic of NPO and carrying out directive science and technology services, could science popularization attract the public engagement and achieve the aim of enhance scientific literacy.

Conclusion

The optimum operation of society needs the well-organized coordination of government, enterprise and NPO, and the construction of science popularization system also needs the cooperation of government, enterprise and NPO. As the important supplement of government and traditional social organizations, the grass-root NPO could further recognize the needs of grass roots, meet the multiple requirements of society, how to exert its function in science popularization is a considerable subject.

First, a benign environment for grass-root NPO is necessary when it carries out science popularization work. Whether the public is fond of science and technology and could engage in it to some extent depends on whether their requirements are fully met. The science popularization activities carrying out by NPO with official background only could meet the middle-level citizens’ requirements. So the current dual-management system should be revised in order to extend grass-root NPOs developing space, they should be endowed the official legitimacy, social legitimacy, political legitimacy and legal legitimacy.

Second, grass-root NPO should be encouraged to engage in science popularization activities. Due to various limitation and barriers, entering the field of science popularization for grass-root NPOs is difficult, especially for the activities with strong specialty. Which needs the government support and encourage them to take part in. This kind of encouragement should include cultivate talents, provide capital etc. science and technology talents should be encouraged to find jobs or take part-time jobs at grass-root NPOs, the financing channel should be extended, and at the same time encourage the enterprise and individual to donate through perfecting the taxation policy should be implemented.

Finally, the social climate of absorbing grass-root NPO should be cultivated. The traditional convention of China makes the public form a mind of resistance towards NPO. For them, non-profit organization is non-government organization, so non-government equals to anti-government. This public opinion results in the dilemma of NPO, especial for the grass-root NPO. To create a benign social climate for grass-root NPO during their development and engagement in science popularization is significant, which could give them much time and energy to carry out science popularization activities.

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Table1. Question classification

Scientific Knowledge	Biology	C1-3. It is the mother’s genes that decide whether the baby is a boy or a girl. (d)
		C2-5. Human beings, as we know them today, developed from earlier species of animals. (a)
		C4. “DNA”
	Geography	C1-1. The centre of the earth is very hot. (b) C1-5. The continents on which we live have been moving for millions of years and will continue to move in the future. (c)

		C2-9. It takes one day for the earth to go around the sun. (f)
	Engineering	
	C5. "Internet"	
	Physics (e)	C2-6. All radioactivities are man-made.
		C2-7. Lasers work by focusing sound waves. (h)
		C2-8. Electrons are smaller than atoms. (g)
	Medical Science (i)	C1-4. Antibiotics kill viruses as well as bacteria.
C3. "Molecule " Scientific	Chemistry Methods research"(C7),	"scientifically
Scientific Spirit "Science and	"Comparative experiment"(C8), "Probability"(C9)	

Superstition"(C10),
"Science and Personal
Behavior"(C11)

Since data could only be analyzed in terms of bi-variate response variable with culture distance model (Raza G, S. Singh, 2007, 2009) and question types of the four categories were different from each other, standardization was carried out in the dataset before analyzing. The nine questions on science view were mainly simple statements of scientific information and the responses were solicited in terms of 'True', 'False' and 'Don't know'. 'True' indicated that the respondent knew the correct answer and 'False' meant s/he did not know the correct scientific explanation. 'Don't know' was recorded as incorrect response. The three questions on science terminology were closed questions. Two options of each question were considered to be the correct answers, which indicated that the respondents understood the terminology, and the other two were recorded as incorrect response. The three questions on scientific method were also closed questions. Only one option of each question was considered to be correct, which indicated that respondents fully understand the method, and the other three were recorded as incorrect response. The response
'do not believe' to the five questions under C10 and the response except 'pray to god bless' to C11 were considered to be correct answers, and the rest responses were recorded to be incorrect.

During the survey all the respondents were instructed to record their education attainment to relevant level. The education level was converted into years of schooling at the time of analyzing the dataset as continuous control variable. For example a response 'primary school' was recorded at the time of interview and converted into 6 years prepared for data analyzing (see Table 2).

Table2. Education scale in China

Education		Illiterate	Middle school	High School	College University	
		Primary school				

Number of Years of Schooling 0,1,2 3,4,5,6 7,8,9 10,11,12
13,14,15 16,17

With the standardized dataset, dichotomous curves could be plotted for each question in Table 1 and values of cultural distance for each question could be computed. In order to get the values of cultural distance of six scientific disciplines listed in Table 1, values of questions under each discipline should be weighted mean using the following equation.

$$n_j$$

$$_iV \quad \spadesuit\Rightarrow \quad \frac{k}{} \quad _j\longleftarrow\supseteq V_j \;\leftarrow\ldots$$

Where,

(1)

14

Vi is the culture distance value of each scientific discipline

Vj is the culture distance value of each question
kj is the number of respondents who gave the right answers to the question*
nj is the number of respondents who were interviewed in the survey*
*For different group, kj and nj are different.

It should be noted that kj/nj is the coefficient of each question for different groups of respondents. It could reflect the degree of complexity of each question for different groups of people. For each scientific discipline, the coefficient indicated the weight of related scientific knowledge or information implied in each question under this discipline for certain specified cultural group or a subgroup. With this equation, culture distance values of different scientific concepts of different groups of people could be computed.

Contrastive Analysis on culture distance based on 2010 survey in China

With the adjusted model described before, based on the dataset of 2010 survey in China, the culture distance values of general respondents and different groups were obtained. Contrastive analysis among the four surveys that had been conducted in China in year 2003 (China S&T Indicators, 2004), 2005 (China S&T Indicators, 2006), 2007 (China S&T Indicators, 2008) and 2010 and between various groups, such as male and female respondents, and respondents in different regions, were carried out in the following part.

Culture distances in general

Cultural distances of science-view: As shown in Fig. 1, the culture distance values differed greatly among the nine questions. ‘The theory of evolution’ (a) was placed closest to the quotidian life of Chinese citizens with the values being 3.7 (2003), 3.6 (2005), 4.2 (2007).and 5.3 (2010). ‘Antibiotics kill viruses as well as bacteria’ occupied the farthest end of culture distance scale. The values of cultural distance were 18.2 (2003), 19.2 (2005), 16.7 (2007) and 17.9 (2010). Here we can notice a sharp rise in culture distance values of ‘earth revolution’ (f) between 2007 and 2010. The reason for this increase may be located in the expression of the question which might have easily confused respondents between rotation and revolution of the earth. The culture distance values of other questions remained almost the same over the years with minor fluctuations.

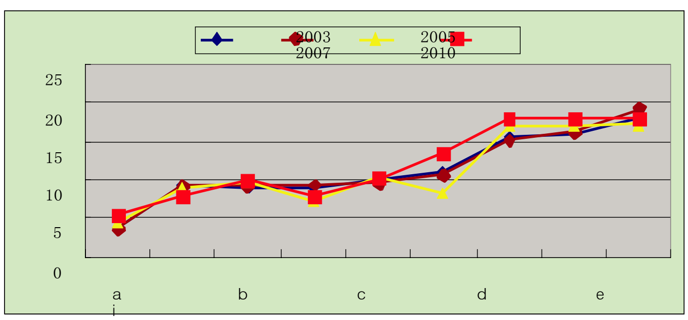

Figure 1. Culture distances on science view of the four surveys in China

Culture distances of scientific terms: The culture distance values of ‘DNA’ and ‘Internet’ decreased on the whole, whereas the culture distance value of ‘Molecule’ visibly increased over the years (see Fig. 2).

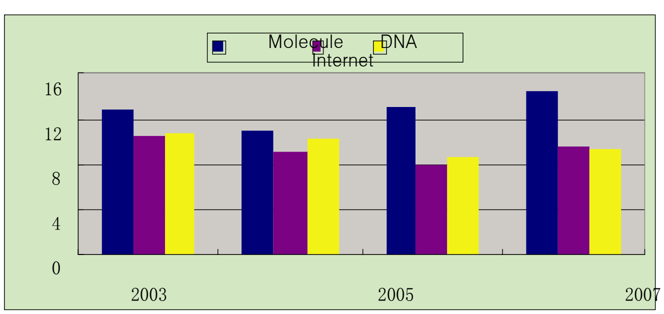

Figure 2. Culture distances of scientific terms of the four surveys in China

The results reflected that compared to ‘Molecule’, ‘DNA’ and ‘Internet’ stayed closer to Chinese citizens’ quotidian life. People intended to seek more information about ‘DNA’ and ‘Internet’ use in daily life and work.

Culture distances on scientific methods: From Fig. 3, we can see that the culture distance values of ‘comparative experiment’ and ‘probability’ stayed at a certain level over the years with minor fluctuations. But an obvious raise could be noticed on the culture distance value of ‘understanding of ‘scientifically research’’ from Fig. 3. Science communicators in China should pay attention to this phenomenon.

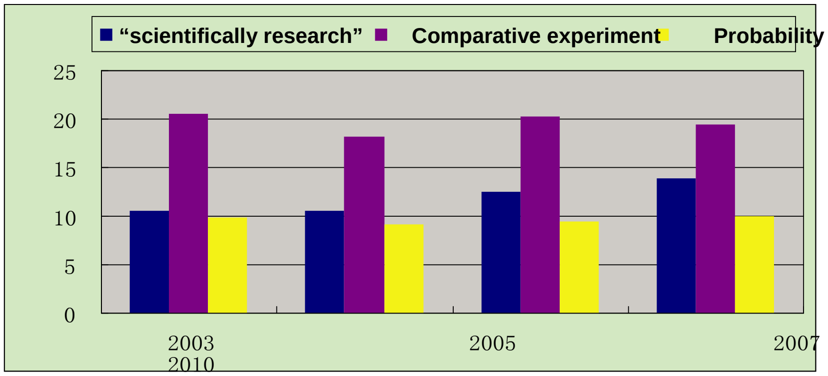

Figure 3. Culture distances on scientific methods

The culture distance values of the two parts on scientific spirit decreased over the years (see Fig. 4). ‘Science and personal behavior’ stayed much closer to the quotidian life of Chinese citizens than ‘science and superstition’. It showed that Chinese citizens’ personal behavior in their daily life became more scientific. Promoting science over superstition through science popularization needs to intensified in China.

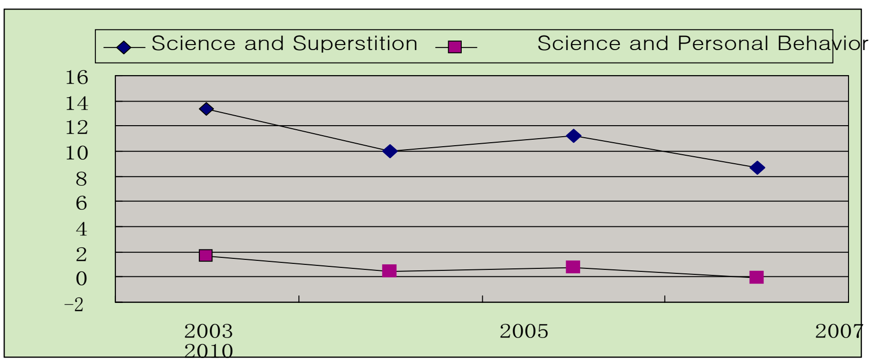

Figure 4. Culture distances on scientific spirit

Culture distance of gender groups

The culture distance values of the six scientific knowledge disciplines of male and female respondents were computed with adjusted cultural model stated above. The results showed that scientific knowledge and information about biology stayed closest to the quotidian life of both genders with the scores being 7.3 (male) and 7.7 (female) (see Fig. 5). Information and knowledge about medical science placed at the longest culture distance scale. For male and female respondents the distances were 18.6 (male) and 17.5 (female). The other four disciplines occupied the places between these two extremes along the culture distance scale, which were geography (9.9 for male, 11.3 for female), engineering (9.1 for male, 9.5 for female), chemistry (14.0 for male, 14.9 for female) and physics (14.3 for male, 16.9 for female) in ascending order according to their culture distance values. It could be noticed that the culture distance values of all the scientific knowledge disciplines of male respondents were lower than that of female, except that the culture distance value of medical science of female respondents was lower than that of male and universal sample. We can also see that the gaps of culture distance values between male and female on geography and physics were obviously bigger than the other four. The reason to these two phenomenons might be the difference in structure of mind of these two gender groups. Men were more likely to absorb and accept knowledge and information with strong logic like physics and geography, but women prefered to get information and grasp knowledge related to health and personal care. So in order to make science communication effectual for different gender groups, different transmission methodologies with a focus on specific content should be formulated according to knowledge structure needs of male and female.

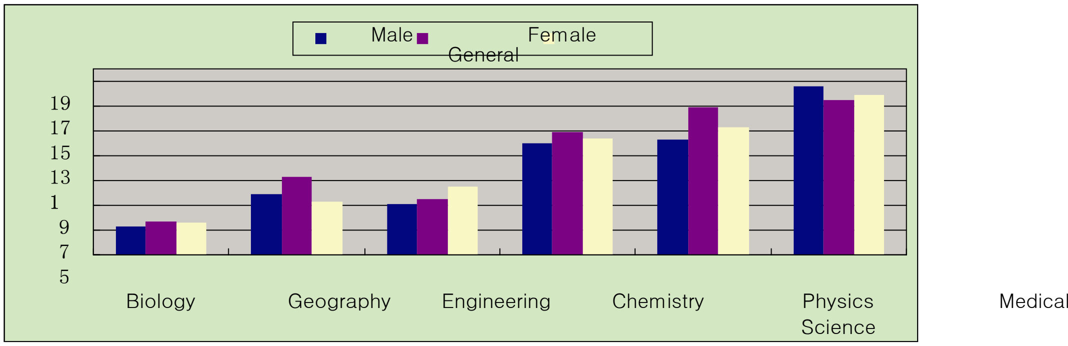

Figure 5. Gender difference on scientific knowledge

The culture distance values of ‘scientific knowledge’, ‘scientific methods’ and ‘scientific spirits’ of male and female respondents were also computed with the adjusted model. It could be seen in Fig. 6 that the culture distance value of female on scientific methods was lower than that of the male and general. The culture distance values of male-scientific-knowledge and spirits were lower than that of female and the latter one was much lower. The reason could be attributed to low level of exposure to scientific method which women get in traditional societies. Special effort should be made in promoting scientific spirits among female group.

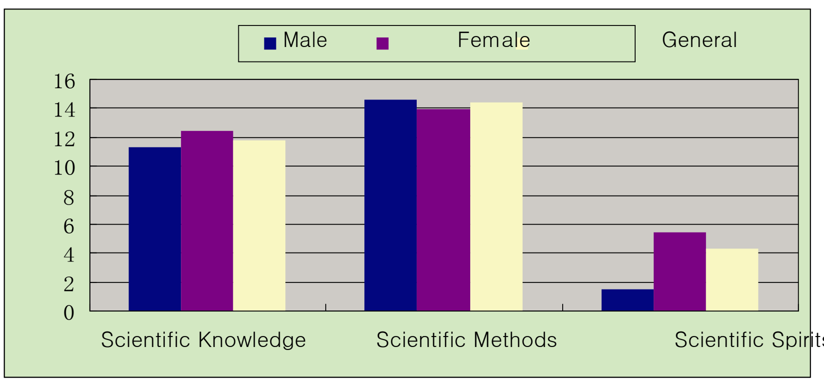

Figure 6. Gender difference on understanding of science

Culture distance of various provinces

Using the national representative data collected in 2010 survey, culture distance values of questions in Table 1 could be computed for all the thirty-two provincial units in mainland China. According to RCDI (National Survey Research Center at Renmin University of China, 2008), thirtyone provinces in China were divided into four categories. For the present discussion two provinces from each category were selected (see Table 3). Beijing and Shanghai represented the region which had the highest comprehensive development level across China. Jiangsu and Jilin were located in the coastal area, which were less developed than the first category. Shanxi and Chongqing represented the region which had the middle comprehensive development level and were also located in central China. Yunnan and Qinghai belonged to the least developed category which were located in western China. Values of different scientific disciplines for each of these provinces were computed with adjusted model. Values of scientific knowledge for each selected province were also computed (see Table 4). Subsequently, all the eight provinces were ranked on the basis of their cultural distance from each of the six scientific disciplines. Value 1 was assigned for the lowest cultural distance and 8 occupied the outermost end (see Table 5). In the following paragraphs an effort has been made to present the salient features of the rank distribution.

Table3. Eight provinces selected according to RCDI

Categories	Provinces
¢ñ	Beijing, Shanghai
Ⅱ	Jiangsu, Jilin
Ⅱ	Shanxi, Chongqing
Ⅱ	Yunnan, Qinghai

The relative position of cultural distance for all the disciplines remained nearly the same across each province. For all the eight provinces, 'biology' could be placed at the shortest cultural distance and 'medical science' could be placed at the farthest end. In between, the value of cultural distance for the other four disciplines i.e. 'enginnering', 'geography', 'chemistry' and 'physics' increased progressively. For example, Shanghai, which belonged to categoryⅡ, ranked the first place in scientific knowledge with the value of 10.0, the computed values of biology, engineering, geography, chemistry, physics and medical science for Shanghai were 5.9, 8.5, 8.8, 12.3, 13.6, 13.9, respectively. Correspondingly, for Yunnan which was much less developed than Shanghai, scored the third place in scientific knowledge, and the respective values of the six disciplines were 6.9, 8.4, 9.8, 12.9, 14.5 and 15.9. Though there was a big gap in comprehensive development level between Shanghai and Yunnan, the differences of cultural distance values of scientific knowledge and six scientific disciplines were small (less than 2) between these two provinces. Another example, still comparing with Shanghai, Beijing which was on close level of comprehensive development with Shanghai, ranked the sixth in scientific knowledge with the value of 11.7. And the corresponding values of the six disciplines for Beijing were 6.6, 8.3, 9.7, 15.4, 16.4 and 23.5. Big gaps could be seen in cultural distance of certain disciplines such as medical science (almost 10) between Beijing and Shanghai. These showed that the culture distance of different area was not directly related to its comprehensive development level. It also showed that people's level of understanding for each scientific discipline varied greatly among provinces.

It should also be noted that absolute values of cultural distance for various scientific disciplines varied a great deal across provinces. Jiangsu scored the lowest on cultural distance scale for physics with the value of 13.3, and Chongqing scored 19.2 for the same scientific discipline. Jilin was placed at the largest cultural distance for chemistry with the value of 20.4, where as, for Shanghai the score of chemistry was quite low, i.e. 12.3. It is evident that using this adjusted model, if a province was taken as the reference point, the cultural distance of each scientific discipline could be mapped and strategies to bridge the cultural distance for each category of scientific knowledge could be devised.

Table4. Relative cultural distance of the selected Chinese provinces

	Biology	Engineering	Geography	Chemistry	Physics	Medical science	Scientific knowledge
Beijing	6.6	8.3	9.7	15.4	16.4	23.5	11.7
Shanghai	5.9	8.5	8.8	12.3	13.6	13.9	10.0
Jiangsu	6.2	9.0	9.1	13.8	13.3	17.3	10.5
Jilin	8.2	9.1	10.9	20.4	16.1	>25	11.3
Shanxi	7.5	9.3	9.1	15.0	15.1	18.2	11.5
Chongqing	9.1	10.2	12.6	16.0	19.2	18.4	13.9
Yunnan	6.9	8.4	9.8	12.9	14.5	15.9	10.9

Qinghai	7.9	9.7	11.0	16.6	16.6	18.1	12.6

Table5. Ranking of provinces based on cultural distance

	Biology Physics	Engineering Medical	Geography		Chemistry		Scientific knowledge
						science	
Beijing	3		4		1		5
6	7		6				
Shanghai	1		1		3		1
2	1		1				
Jiangsu	2		2		4		3
1	3		2				
Jilin		7	6		5		8
5	8		4				
Shanxi	5		3		6		4
4	5		5				
Chongqing	8		8		8		6
8	6		8				
Yunnan	4		5		2		2
3	2		3				
Qinghai	6		7		7		7
7	4		7				

Conversely, if we take a scientific discipline as the reference point, then various provinces could be placed at varying degree of cultural distance. For example, in order to democratise the knowledge of biology, Shanxi will have to travel a longer cultural distance compared to the population of Yunnan, Beijing and Jiangsu. Thus, it could be concluded that the strategy to communicate knowledge of biology to the people in Jiangsu may not work in Yunnan or Shanxi. In other words, if a scientific notion was to be democratised among a province, specificities of their cultural-cognitive-structure would have to be taken into account. It could also be pointed out that with the adjusted cultural distance model, differences in structures of people's cultural mind in different areas could be probed. Scientific notions placed at large cultural distances were not expected to become a part of the people's cultural thought through short term solutions. Thereby, suited and effective measures could be adopted by local science communicators referring to the analytical results presented here.

Conclusions

The adjusted model well described the status of public understanding of science in China in a different perspective. It is evident that based on this model index for measuring level of public understanding of science could be constructed without declaring sections of society as 'scientifically literate' and 'scientifically illiterate'. It also evidently reflected the scientific awareness level of different gender groups and areas for different scientific concepts. As the level of complexity increases the relative cultural distance, of scientific phenomenon, tenet or information, from the quotidian life of populace also increases. Using the model relative culture distance between various scientific notions and people's structure of thought in quotidian life were mapped among genders and areas. Based on these maps, strategies for effective communication of science, specific to various cultural groups and different areas, can be formulated.

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12. Construction of PUS Index in China–An Empirical Study on the Database of China 2010 Civic Science Literacy Survey

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Abstract. This paper is concerned with an empirical study on the database of 2010(the 8th) Civic Science literacy Survey of China. By learning from latest theoretical achievements of relevant scholars and considering the features of Chinese practice, the author extracted a Model of China Public Understanding of Science(PUS) Index from the latest Civic Scientific Literacy questionnaire .The constructed China PUS Index contains 5 indicators as following: Knowledge (public knowledge of S&T), Attitude (public attitude toward S&T), Interest(public interests in S&T), Engagement (public engagement of S&T)and Information (the information channels of S&T). Confirmatory factor analysis (CFA) accompany with other relevant statistical methods, was applied to evaluate the validity of this Index model. Under the framework of China PUS Index, the Author profiled several characteristics of China public understanding of science at present stage, and provided an open platform for further comparative study under different social and cultural contexts in PUS field.

Keywords: Public understanding of science, Confirmatory factor analysis (CFA), PUS index

Introduction

Since the Scientific Literacy of Chinese citizens was firstly carried out in China 1992, how to assess the level of civic scientific literacy, as the core content of previous investigations, remained as the focal point by people of various circles. Using the percentage to show public Science literacy level has shown significant limits already, which has been in application since the first survey in China. On one hand, the duality logic by which to assess whether a respondent obtains a qualified level in scientific literacy or not, is a rather arbitrary evaluation. At the meantime, the duality logic was on the loss of gradate information in scientific literacy level of respondents. On the other hand, by the percentage method can only get a simple category variable from survey results, which can hardly support the in- depth follow-up data analysis.

For the above, during the data analysis course of the seventh survey of Chinese Public Scientific Literacy (2007), the research group created the Chinese Public Scientific Literacy Scientific Index (CSLI). The CSLI index integrated a number of core indicators of scientific literacy into a single form. The CSLI index stands for the total score of all the correct answers in tested questionnaire for a respondent, while for groups the CSLI index shows the weighted average scores of every individual in the group. Compared with the percentage result, the introduction of China Scientific Literacy Index has several advantages as following:

(1) The adoption of all respondents reply information improved the efficiency of survey data application.
(2) Survey results will be adopted as a continuous variable, which can support the division of citizen's scientific literacy level to be more accurate.
(3) Provide a basis for integration of 'public access of science and technology information indicators, 'public attitude towards science and technology' indicators and citizen science literacy indicators.

In 2010, the sample designing for the 8th scientific literacy survey of China was based on the population in mainland China, while take 32 provincial-level units in mainland China for the sub-population. In each provincial unit a three-stage stratified sample of the PPS was applied. To take provincial units as sub-population for sampling was designed on biggest advantage to describe the situation of each provincial unit and to enable comparative study on provincial level. The index system in 8th survey followed the major structure of previous surveys. The core questionnaire was composed by three parts: 'public science and technology information sources', 'public understanding of science and technology', 'public attitude towards science and technology'. Some relevant static indicators were also including in the questionnaire such as: gender, age, education level, district, social groups, professional and some other background variables. This paper intends to extract a Model of China Public Understanding of Science (PUS) Index from the latest Civic Scientific Literacy questionnaire. With reference to the CSLI index and the international model of PUS, the China PUS index has also been combined with the questionnaire items related to the PUS content

Selection of Indicators

In fact, the ‘public understanding of science’ model is taking PUS index as a complex has strong-related with the public interest, knowledge and positive attitude toward science and technology. However, it becomes a priori definition: one has the ‘scientific literacy’ only if he expressed a ‘certain level’ of interest on science and technology, obtains “adequate” S&T knowledge and holds a ‘positive’ attitude towards the role of science and technology.

Based on the questionnaire and the follow-up data analysis principles, we defined the model of the Chinese public understanding of science index in five dimensions ,including scientific knowledge, attitudes, interests, participation and information indicators. As for the five dimensions, there are 8 items from former scientific literacy indicators to make up of scientific knowledge, 6 items about interests in the interests dimension, 12 subjects formed the participation indicators, 4 items for the informness index, 4 attitude indicators involved in the formation of attitude indicator.

Scientific knowledge dimension is the base of the model of public understanding of science. Taking the feasibility for international horizontal comparative analysis into account, we selected nine items from the questionnaire (two knowledge items in the survey conducted in China were combined) which already widely adopted in PUS surveys, the specific as follows: (Table 1)

Table1 The construction of Knowledge indicators

knowledge	Item
k_earth	Geocentric temperature is very high.(C1_1)
k_around	It takes one day the earth to turn around the sun .(C2_9)
k_oxygen	The oxygen for breathe comes from plants. (C2_2)
k_gene	It is mother’s gene to determine the gender of kids. (C2_3)
k_electron	Electron is smaller than atom.(C2_8)
k_antibiotics	Antibiotic can kill virus.(C1_4)
k_continents	Millions of years, continents have been slowly drifting, and will continue to drift (C1_5)
k_evol	So far as we know, human being is evolved by early creatures. (C2_5)

Public interest in science and technology indicators made up by the respondents interests in six topics, including: new scientific discoveries, new inventions and technologies, new medical advances, agricultural development, industrial technology development and conservation of resources and energy.

Limited by the difference in ways of questioned, information sources dimension was mainly through the participation in S&T activities of the respondents during the last year as pay visits to the popular venues and science popularization activities.

Cos of there was not directly address the degree of the public awareness of science and technology information in latest questionnaire, we took how citizens participate in scientific and technological affairs as items to constitute an informness degree approximately. According to the respondents experience in taking part in the S&T affairs and business including: talking about technology topics, participating in technology-related discussions or hearings related with atomic energy, biotechnology or environmental topics, the extent of public S&T informness dimension was constituted.

There were quite a lot of items including in the questionnaire on the attitude dimension. To avoid too many interference items in this dimension, we applied the factor analysis on all of the attitude items and two main factors were selected from two topics. (Table 2)

Table 2 Rotated Component Matrix (a) on attitude indicators

Public attitude towards S&T		
Component	1	2
Modern science and technology will provide more opportunities for new generations.	.748	.057
Scientific and technological progress will help to treat AIDS and cancer and other diseases.	.667	.143
Science and technology do not solve any problems we faced.	.025	.711
Continuous application of technology will eventually destroy our planet.	.186	.664

Finally on each dimension we get an indicator with its value range and the code of score for each item was given in Table 3.

Table 3 Value for each indicator

indicator	value	code
knowledge	[0,8]	1,0
interest	[0,18]	3,2,1,0
participation	[0,15]	1,0
informness	[0,12]	3,2,1,0
attitude	[-4,4]	2,1,0,-1,-2

Indicator Analysis and Construction of Index

After the Correlation Analysis between knowledge indicator and other 4 indicators, we found the standard assumption of linear relationship in PUS model showed some interesting phenomenon. Mapping the correlation with the fitting curve equation, we get the relationship between knowledge and other 4 indicators. (Data stands for each provincial unit)

Knowledge and interest

Although citizens in each province may vary a lot from their interest in science and technology, science literacy level has no obvious correlation with interest. So the interest on S&T may come from the influence of the local media environment rather than the knowledge level. (Figure 1)

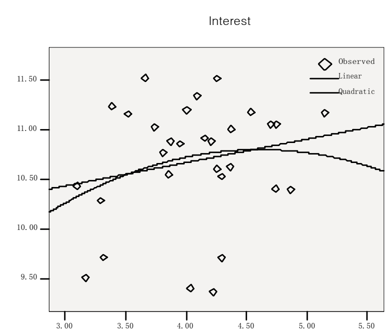


Figure1: Correlation between Knowledge and Interests

Knowledge, engagement and informness

Public Engagement in S&T means the frequency respondent visited S&T popularization venues in last 1 year to assess the extent of public participate in science and technology activities. Knowledge and engagement indicators are in line with the linear relationship assumption. It means that people with high level of S&T knowledge usually participate in science and technology activities, visit science and technology venues more frequently. According to Figure 2, the right axis of knowledge indicator shows that people from major cities and some developed provinces in eastern part of China visit to science and technology museums and participate in scientific activities more frequently, while people from western part of China has lower frequency of engagement in S&T activities. This phenomenon indicates the uneven distribution of public resources in science and technology popularization in China currently.

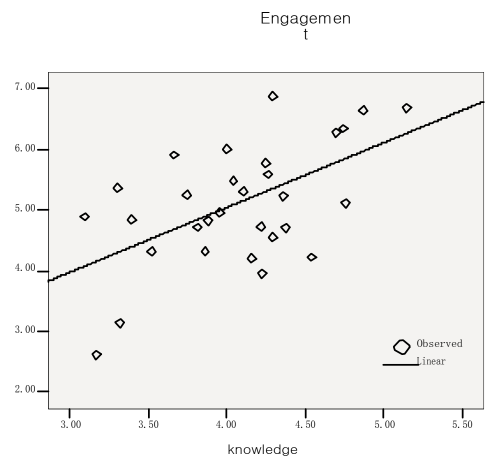


Figure 2 correlations between engagement and knowledge

The informness indicator in China PUS index stands for the extent of involvement of people in science and technology affairs. We can tell from Figure 3, the correlation between knowledge indicator and informness indicator is also consistent with the linear hypothesis.

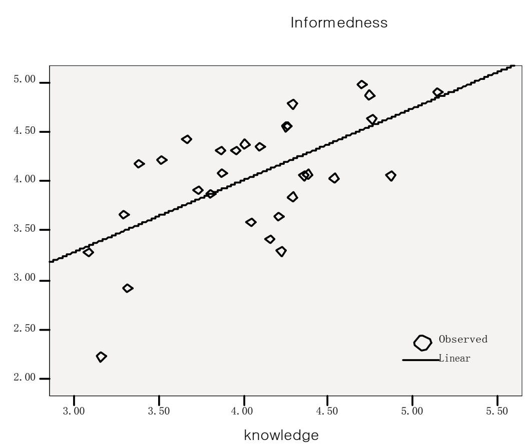


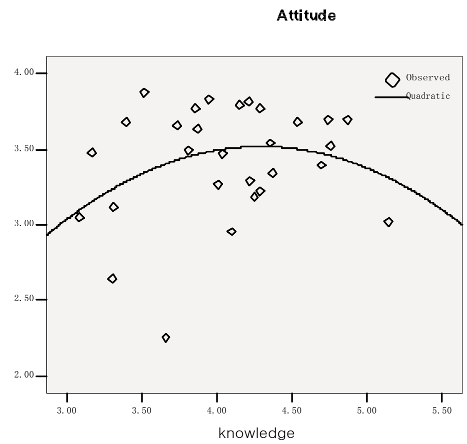
Figure 3 correlations between knowledge and informness

Knowledge and attitude

The ‘two cultures’ model in PUS research shows that only in a specifically circumstance, the interests indicator, knowledge indicator and attitude indicator will be in strongly positive correlated. The mutual correlations were significant impacted by level of industrial development of the regional environment within a certain range. (Bauer, Durant & Evans, 1994; Bauer, 1993)

In industrialized societies knowledge indicator has a positive correlation with positive attitude, while in post-industrialized societies the relationships among knowledge, interest and attitude have great difference from industrialized societies. Especially, the correlation between knowledge and positive attitude was no longer as we got from industrialized social background. This is also the key argument from ‘two cultures’ model theory.

Among provinces of China the relationship between knowledge and attitudes also showed a similar law. Under a certain level of S&T knowledge level, people with higher level of scientific knowledge tend to obtain the more positive attitude toward science and technology. When people’s knowledge level exceeds the certain range, attitudes and knowledge will show an opposite relationship. By nonlinear analysis, we found that the separation point for the ‘two culture’ groups is the point which knowledge score 4.3and attitude score is 3.5. It can be concluded from figure 4 that on the both sides of separation point the relationship between attitudes and knowledge showed totally opposite result. According to further comparative data analysis, the developed provinces in eastern part of China and special municipalities showed the PUS characteristics of post-industrial society, while the western region near the border areas showed characteristics of industrialized society.



Separation point P(Y=3.52 x=4.3)

Figure 4 nonlinear analyses between knowledge and attitude

Because of the nonlinear correlation of knowledge and attitude indicators, we need do linear transformation on knowledge and attitude value before get the final formulation of PUS index.(Figure 5) Here is the relevant mathematical conversion:

Ki stands for the score of knowledge value of the ith (i=1, 2,…, 32) province; kp stands for the knowledge value of separation

Attitude= Attitude if ki<=kp

Attitude = 2*Attap - Attitude if ki > kp

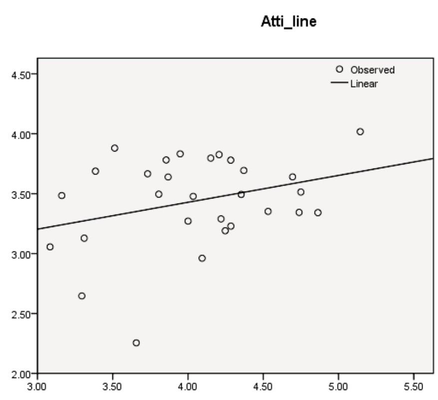


Figure 5 Correlation between knowledge and attitude after liner transformation

Chinese public understanding of science index and validation test

As already discussed before, we already made it clear on the composition of public understanding of science index and the correlation between each indicator with scientific knowledge. As for built up the index formulation, we need to determine the coefficient of each indicator. These factors reflect the importance for each dimension to the total score.

In this paper, the index coefficient was determined by factor analysis method. The factor loading coefficient shows each factor’s contribution to common factor, and the variance contribution ratio stands for the extent of common factor’s representative to all sample variance. Therefore, the result of factor loading coefficient multiply with variance contribution stands for each indicator’s contribution in the whole sample. The contribution of each index divided by the contributions of all the indicators can get the weight of each indicator; the formula is expressed as:

$$\omega_i = \frac{\sum_{j=1}^{m} \beta_{ji} e_j}{\sum_{i=1}^{p} \sum_{j=1}^{m} \beta_{ji} e_j}$$

$$(i = 1, 2, \cdots, p \quad j = 1, 2, \cdots, m)$$

At last we get the formulation for China PUS index as follows:

PUS=0.1612*Knowledge+0.1211*Attitude+0.1014Interest+0.2394Informedness+0.2465Engagement After

get the result of PUS index and average scores of PUS index in mainland China, we classified 3 groups in mainland china respondents (by two-step cluster analysis),the characterize of each group was shown in Talbe4.

Table 4 cluster analysis of PUS index in Chinese citizens

Cluster	Mean	SD	Gender	Education level	Rural/Urban	Region
1	2.23	0.87	More female	Primary	More rural	western
2	4.56	0.67	average	Medium	average	average
3	6.96	0.91	Moremale	college	More urban	eastern

Cluster analysis by pus index can largely profile the distribution of the various background variables. This result of cluster analysis generally meets the actual situation in China and shows the selection of pus indicators is reasonable.

Conclusions

Due to space limitations, this paper can not make further discuss on the formed PUS index and make abundant analysis by applying this PUS index. There are all sorts of method on subjective attitude measurement theory, while each country and culture has its own characteristics and complexity. Based on the eighth survey of Chinese citizens’ scientific literacy, we applied a more accepted index for public understanding of science under international circumstance to Chinese practice for the first time. Then the research group tried to construct a new evaluation index on Chinese public understanding of the science. At present, we can conclude some key features for Chinese people from PUS index result. To get more accurate analysis and valuable conclusion, further improvement in the index system and in-depth data mining are very necessary. We expect this discuss can lay a solid foundation for PUS index research in china and open a new platform for international comparative research.

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13. Developing Countries and Information Deficiency

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Abstract. We sometimes suffer from Information Deficiency (ID) in everyday life. We can find the Information Deficiency similar to vitamin or mineral deficiency problems faced everyday by people who lack of good nutrition. When someone is short of vitamin A, we find them suffering from several physical symptoms such as color blindness etc. The doctor may diagnose it as vitamin A deficiency and prescribe an extra dose of it. Similarly, when someone suffers from Information deficiency, we find them not working optimally or unable to address an important problem and solve them. We can cite several interesting examples of information deficiency at several levels. A person may have a PC but may not know how to connect to the internet and access the email. Another example can be that of a computer that may not have the right update to the antivirus and thus can become vulnerable to latest virus threats.

Information deficiency can be sometimes thought about as opposite to Information Overload. Information overload is availability of excess information and inability to find time or energy to process it. There is so much of literature on Information Overload on the internet. I think Information Deficiency is distinct from Information overload. Even in presence of Information overload, a person may suffer from information deficiency. Information deficiency arises out of unavailability of useful information at right time and right place. The value of information thus is space-time related. The value of Information becomes judged based on the demand it has and its time criticality. How much urgently a piece of information is necessitated.

Recently, I went to a newspaper vendor and wanted to buy a paper. The paper vendor told me all the newspaper issues with him were sold out. I asked him the reason. He told me the reason was the headlines, i.e., a bomb had exploded somewhere and people were eager to read about it and know about it. We can see that people want to cover the Information deficiency created by a news item and seem to rush to find out more through newspapers, internet, television and various other mediums. The suspense created in a terrorist attack or plane crash or tragedy connected with earthquake or volcanic eruption etc create information deficiency syndrome among people temporarily. Few days later, when I went to buy the newspaper with the same vendor, I could see him having lots of unsold papers. As the headlines were less dramatic and were unable to trigger an appetite among the public for more information, the interest in buying the news papers had diminished.

We see the Information deficiency playing a vital role in software industry. Do the software engineers have the right information to build the applications or systems their customers are demanding? This is the question addressed in the requirements phase of the software project. Information deficiency in a software project can lead to delayed project schedules, misunderstood customer requirements, software malfunctions etc. During interviews for software jobs, we can observe the interviewer assessing the prospective candidates potential for information awareness. If the candidate is suffering from information deficiency, and the interviewer is smart enough to examine it through questions, surely it will go a long way in selecting right people.

In Universities and Institutes, we find the students preparing for examinations and tests. Their preparation indirectly is to cure their information deficiency. Another place we see the information deficiency playing a vital role is the quiz competitions. Surely, quiz participants need to be well prepared in order to be successful in a quiz contest. Information deficiency is predominant in other professions too such as medical, legal, etc. Lack of information about medicine or diseases, can be leading to increased fatalities in hospitals. Information Deficiency plays a vital role in healthcare and medical world. The spread of new kinds of diseases brings in a challenge for diagnosis, treatment etc. The doctors and patients face a situation of Information Deficiency regarding diagnosis, treatment, symptoms, drugs etc.

In the developing countries, we find information deficiency playing a vital role due to several factors such as lack or limited telephone and computer networks, frequent power outages, inadequate infrastructure, higher patient to doctor ratio, illiteracy, etc. An effort to improve the information availability and literacy will have significant impact on the overall health and wellbeing of population.

14. Science Communication an important tool for Science Popularization: A Case study of Uttarakhand Council

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Abstract. Uttarakhand is formed on 9th November, 2000 as the 27th state of the country after separation from Uttar Pradesh. The state is often called as “the land of Gods or Dev Bhoomi” because of the presence of Charam Dham (Badrinath, Kedarnath, Gangotri and Yamunatry) and bestowed with rich natural resources i.e. forest, rivers, flora , fauna etc. State is 80% hilly and having tough terrain and frequently affected by the natural clematises. In this condition it became very difficult to provide the good education facilities to the inhabitants especially in Science, in which lot of explanation (practical) is involved. In order to boost the scientific temper among the masses of the state, Uttarakhand State Council for Science & Technology (UOST) started functioning in June, 2005 at Dehradun as a nodal agency of Department of Science & Technology (Govt. of India). The important mandate of Council are: (1) Research & Development

(2) Science Popularization
(3) Entrepreneurship Development Programme

(4) Himalayan System Science.

In the present paper an attempt has been made to highlight the indicatives taken by UCOST for creating Science awareness through Science Communication. Since its inception a large number of campaigns (Planet Earth, WASH, International year of Astrology, International year of Biodiversity etc.) & large number of workshops (Intellectual Property Rights (IPR), Water Testing, Technology demonstration, Role of print and electronic media in science communication, etc.) related to different issues of Science & Technology were organized by Council in every corner of the State through agency SPECS (nodal agency of Council for Science Popularization in Garhwal), PAHAL (in Kumaon) and District Coordinators. As per the analysis approximate 15,000 inhabitant i.e. Students, Researcher, Scientist & Common masses etc. were benefited in various issue of Science & Technology. It is concluded that by proper planning & action plan, Science Popularization can be archived, which can improve the socio-economic status of the state.

Keywords: Science communication, Science Popularization, UCOST, Campaign and Uttarakhand

15. Efficacy of Using Drama Techniques for Science Communication

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Abstract. This paper will focus on the use of Drama Techniques as a provocative and engaging methodology in creating background for efficient science communication and discuss its usage in the classroom, training environment, and the community. The paper will also explore how this unique educational tool can facilitate personal growth, raise consciousness, and initiate behavioral change. The components of the techniques and examples of effective use will also be discussed.

Keywords: Drama techniques, Science communication, Russia

Introduction

Though Drama Techniques are quite developed in the world they nevertheless are misunderstood in the country of prosperous theatre (Russia). Mostly they are regarded as the process of acting and role playing. But they are more than that.

Another obstacle here in Russia is considering communication among scientific societies to be more important than the relationship of science to the broader public. The Education Ministry (pre-school, primary, secondary, college education) is expected to fulfill the role of connecting the public to science. At the same time there is a tendency to desystematize the traditional way of educating which peaked in quality 20 years ago and then brain washing and anarchy in the wake of the USSR fall and now new reforms seeding chaos, disrespect and consumerism in impressionable youth.

In addition, TV broadcasting, computer games and the internet are forming a new rhythm of information perception - impulsive, based on bright, quickly changing elements. New educational tools are required to meet the demands of the generation to follow which finds no use in some science subjects at school.

As we see here, Russian traditional education is almost extinct, while the new one is still developing, and at this stage it is quite urgent to discuss the efficacy of science communication which cannot exist without the proper educational background.

Drama Techniques are about working with rhythm, ways of appealing to participants and carrying them away into reflection, communication, thus improving them in different aspects.

Efficacy of science communication is rooted in circumstances shaped, modeled and organized by drama techniques:

A positive mood influenced by drama techniques can boost one's positive acceptance of science communication.

Through its spontaneity and emotional intensity, Drama Techniques can focus attention, heighten awareness of scientific knowledge importance. Well-scripted curricula with emphasis on practical applied science might boost students' interest in details, profound learning and participating in science communication.

Gradual encouragement will boost students' confidence in ability to understand complicated scientific material.

Methodology

Population and participants

The study was conducted at the Udmurt State University with students of historical, philological and journalistic faculties. The population sample included 200 students learning English. The students who participated in the pilot study were not science-communication-oriented. By exploring Drama Techniques in teaching English to draw students into the world of science, a positive outlet for science communication was provided.

Instrumentation

This qualitative study evolved through the collection of the students' responses to the nine-month inclusion of the Drama Techniques for an efficient science communication program by examining the students' writing samples, formulating for pre- and post-interviews and making observations.

General Assumptions Regarding the Drama Technique for Efficient Science Communication

1. Initially, the students will pull away from learning science as an academic subject which puts them in a negative mood, but as a part of an English class in which they are interested, learning English as means of International communication, including communication dealing with science.
2. Some of the class days will be extremely emotionally charged, due to the peculiarity of the program appealing to the nature of most humanitarian students.
3. Due to the transient nature of the university and placements into the program, there will be some changes in the room's makeup during the period of time in which the study takes place to plunge them into some "scientific realities" (observatories, labs, museums…).
4. Students will enjoy the dramatic games and exercises included in the curriculum starting a new stage in science communication.

Provocative and engaging methodology

Drama Techniques might be characterized as a provoking and engaging methodology to appeal to participants and carry them away into reflection, communication, thus improving publics, and students particularly, in different aspects.

Generalizing we may define several strategies to make a well-script of the class:

- warming up with guessing, pre-quiz, wordsplash, free associations, evocative quotation, photo, movement, sound, scenario or song dealing with the topic of the lesson (most of them are aimed on the one hand to provoke them to think, get involved into activities, focus on the theme, on the other hand they help to understand any misconceptions or preconceptions that the students may have about the subject to plan further work more efficiently):
- breaking barriers with physical touching, whispering, leveling… games;
- increasing self-confidence stimulating to communication with compliment training, assuring games, support activities, recalling personal successes, unique skills, loving relationships, positive momentum;
- opening mind to hear more, learn more, analyze more with activating extra-listening skills, introducing word- games (anagrams, paronomasia…) dealing with the themes.

Creating background for efficient science communication

First of all, what is science communication? Generally, it involves some discussion of science with non- scientists, but those who make it are not necessarily scientists; they can have different backgrounds, so the term is usually applied to more 'public-facing' work.

Why do we need science communication? Writing in 1987, Geoffery Thomas and John Durant describe the various reasons for increased Public Understanding of Science as follows:

- Benefits to Science–This is the 'to know is to love' argument, and perhaps mixes up the word 'understanding' with 'appreciation'. It suggests that increased PUS will lead to more funding, looser regulation and more trained scientists.
- Benefits to National Economics–This argues that to compete economically we need trained scientists and engineers, which more PUS will provide.
- Benefits to Individuals–This is based on the sense that we live in a technological society, and assumes that we must know some science to negotiate it (e.g. knowing about surface tension helps us kill spiders).
- Benefits to Democratic Government & Society as a Whole–This train of thought emphasises that a scientifically informed electorate equals a more democratically run society.
- Intellectual, Aesthetic, and Moral Benefits–These arguments assume science is good for the soul in some way and increased PUS will lead to a populous of happier and more fulfilled individuals, perhaps equating science with the arts or religion.[1] But at the same time, writing in 1952, I. Bernard Cohen points out a set of 'fallacies' in arguments for improved science education:
- Fallacy of Scientific Idolatry–'believing scientists to be lay saints, priests of truth, and superior beings who devote their lives to the selfless pursuit of higher things'.
- Fallacy of Critical Thinking–understanding science does not necessarily give you this transferable skill, as 'may easily be demonstrated by examining carefully the lives of scientists outside of the laboratory'.
- Fallacy of Scientism–science is not the best or only way to solve problems.

• Fallacy of Miscellaneous Information–'the belief in the usefulness of unrelated information such as the boiling point of water, the distance in light years from the earth to various stars, the names of minerals'.[2]

The process of popularization is a form of boundary work to benefit without fallacy.

In the US, Jon Miller differentiates between identifiable 'attentive' or 'interested' publics (i.e. science's fans) and those who do not care much about science and technology. Working in a particular surrounding we have to see one's publics have the following four attributes of scientific literacy:

• Knowledge of basic textbook scientific factual knowledge.
• An understanding of scientific method.
• Appreciated the positive outcomes of science and technology
• Rejected superstitious beliefs such as astrology or numerology.

Answering these questions we may find the ways to reach efficient science communication.

But what is efficient science communication?

There are five main components which are implied meaning efficient science communication:

• Dialogue
• Engagement
• Respect for audience and context
• Science and how it matters to society
• Scientists as key actors

Drama techniques are the tools encouraging, catalyzing and facilitating the process of starting and maintaining dialogue making people engaged and respectful for the audience. That's the beginning to the following question we refer to.

Ways of creating background for efficient science communication.

"In this fast-forward world, nothing is more critical than how and what you communicate…"–Dr. Denis Waitley, author of "The Psychology of Winning"

In our case both (how - efficiently, what – science) are beyond criticism. The subjected is the way of creating background for efficient communication, particularly – Drama Techniques. The stage is educational institution, classes of English. Unfortunately, a lot of students in Russia distaste learning science as an academic subject, it puts them in a negative mood. But what if we engage them into a science dialogue as a part of an English class in which they are interested. Through its spontaneity and emotional intensity, Drama Techniques can focus attention, heighten awareness of scientific knowledge importance. Well-scripted curricula with emphasis on practical applied science might boost students' interest in details, profound learning and participating in science communication.

Gradual encouragement will boost students' confidence in ability to understand complicated scientific material.

Results of the Study

Most students have got engaged in science communication by reading more about science, demonstrating a high level of readiness for science communication. There are some more particular facts illustrating the growing of their interest in science communication.

Some students from Journalistic Faculty have got interested in writing articles about science. Some students of historical faculty have decided to participate in the intellectual game "What? Where? When?" challenging them to learn more in the world of science. Some of the philologists have made a scientific project for the local library to embrace more people into the world of science communication.

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16. Can independent and Qualified Science Communication Survive in a Time Dominated by Institutional Interests?

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Abstract. Quality control for research has been performed by independent academic journals. This system is under threat because competing universities and libraries fighting for their mission are reacting in ways that have negative consequences for those journals. Governmental intervention can secure their continued existence but probably at the cost of the loss of academic freedom.

Keywords: Academic journals, Libraries, Quality control, Science communication, Universities

Introduction

Quality control by peers

For many centuries quality control for re-search has been performed by peers and pub-lished in free and independent journals. This system functions as a gatekeeper to ensure suitability of the published manuscripts.

The work is made under the supervision of editors that often are chosen from the best researchers in the respective field. For each submitted article their job is to find the best experts on the article's topic and have them— often two—to give their opinion about the article in a long row of questions about its originality and precision in its presentation of the subject, and the validity of the theories and the data behind and its theoretical discussion in the international research society. At last they give their judgement: yes, perhaps, or no to publishing. Often the answer is

"perhaps" and the author has to improve the manuscript.

After this process accepted articles go through another quality process where the language is edited and made precise, with working illustrations, proof reading, lay out, keywords, control of references and much more.

Indeed, the peer review process has secured the progress of research. Consequently, articles that have been published in such journals have served as a reliable source because journalists could trust the quality.

The quality process made in freedom

This system is managed by independent journals and publishers. The expenses for the editorial process have been paid for centuries by selling the journals to subscribers with a little support from a society or fund.

Under this system, the editorial process has been carried out independent of institutions, universities and the state bureaucracy, functioning as pretty near the ideal to secure "the truth" with a very long arm-width away from politicians and administrators. Often 70 per cent or more of manuscripts submitted are rejected regardless of who the authors are or with what institution they are associated.

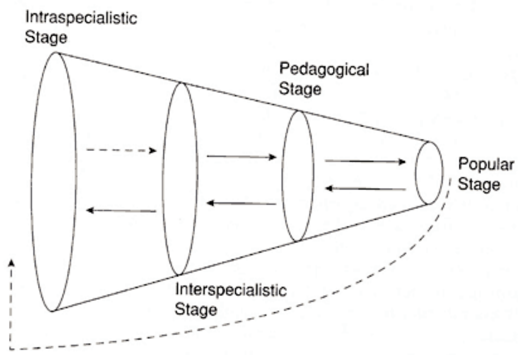
This is very important for the development of science when this judgement is carried out away from institutional and political interests. The other quality systems in the academic world—the examination of students and the employment of teachers and researchers—is made in the institutions, which are often a battlefield of different institutional and political interests.

The perfect public communication process

This quality system has been the background for the process for the public communication of research. The communication process is not directly from the researcher and to public in a linear model but through several steps in a communication process.

This process is described by Bucchi (1998). As seen in the illustration, the intraspecialistic stage refers to peer reviewed academic jour-nals. The knowledge is published in journals intended for scientists from all disciplines, such Nature or Science. The next stage is the pedagogical stage with textbooks and popular science journals, and at the end we have the popular stage with TV programs, newspapers and other mass media.

This ideal communication system ensures that the information in the popular stage is trustworthy and valid because it has been through the quality process.



The Threat From Universities

Bypassing the quality process

Unfortunately, this communication system has changed over the past decade. The communication often happens directly from the researchers (or their institution) and to the popular stage as shown in the bypassing large arrow. At first it could look like an improvement: more research to be published. But when information jumps over the quality process in the peer reviewed journals, the information is published on the conditions of the popular media. It is obvious that the journalists in the tabloid press are not interested in the academic truth or able to judge anything about the quality of the information. They have only one goal, gathering information for a good story.

Therefore we will have a lot of stories about new science breakthroughs that will give cures against cancer and new optimistic forecasts about the enormous potential, fantastic possibilities, and the next industrial revo-lution.

Of course the popular media always had this goal of a good story, but when news comes from academic journals the information was neutral and not marketed with more power than information from other articles in academic journals.

New administrative steering instruments

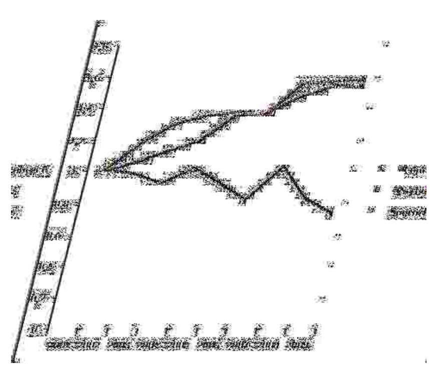
Today, strong institutional interests result in attempts to bypass this system in order to highlight themselves. Regrettably, these institutions are universities.

For example the press coverage in itself is a positive factor. In the performance contract between the Science Ministry and the University of Copenhagen, this measure was counted by the citations in the newspapers. In 2008, the measurement of the success showed an increase of 5 percent.

Please note that there is no effort to track the quality of this press coverage. The object is solely to have a higher number in one of the most popular steering instruments for administrators—the spreadsheet.

The development is the same at all Danish universities. The focus is massive at the mana-gerial level at the universities, and the results are obvious. The diagram below shows the development of the mentions of the universities in Copenhagen and Aarhus compared to the mentions of the Danish top journals in leading newspapers.

The increase of press coverage is enormous for the university stories and the coverage of news through the academic journals is stable or has a tendency to decrease.



Strengthen of institutional interests

This institutional egocentrism exists at the expense of the interests of science itself. The attempts at self-promotion are rooted in various causes.

Foremost the universities are in strong competition with each another. Students are choosing universities based on many factors. Also, universities compete for the best teachers, attention from politicians, and access to large funds.

In an attempt to gain a competitive advan-tage, universities are arming their information departments with journalists and other communications experts. Those new members of the bureaucracy are trying to sell their institution to the mass media and convince them of their particular university's value and superiority. By using in-house media experts to market directly to the media, these universities are short-circuiting the academic quality control process, given that they bypass a review by independent editors.

Consequences for the academic journals

The bypass is not aimed at the university managers but an unintended result of a longer development. The universities are "businesses" with the claim from the governmental administration that they have to be managed by professional management persons.

In Denmark this development was stated by a new university law in 2003 and after that each headmaster, head of a faculty and head of department was appointed by the board and not by his or her peers.

University policy about the learned journals has changed. They are desirable institutions but instead more of a burden.

The examples from the contemporary history of journals are many. For example, the journal Tidsskrift for Arbejdsliv is ranked in the official list of improved academic journals. Its chief editor is from the Danish University of Education, some articles are written by researchers from the university, and the journal is used in the education and research at the university. The university does not support the journal—it had to pay a high rate to have its editorial address at a university; in fact, the university does not even have a subscription to the journal. The central institution in relation to the journal has used large sums of money to create its own journal to promote its own researchers.

This story shows the disinterest in journals and activity directly against the journal content. Many editors are asked to stop their work for cross institutional journals; it is well known that academic journals have difficulty attracting qualified editors.

The Threat From Libraries

The destruction of journals

This chapter will discuss a policy with a rather calculated aim to destroy the publishers of academic journals. Seen from the perspective of the journals, they are presented by political demands to put their articles free on the Internet without compensation. This demand is made by powerful governmental institutions that are trying to force the researchers to follow this policy.

The economy of the journals is affected by this policy because until now the income from the journals has come from selling subscriptions and copies. Therefore the journals will miss its economy to pay for expenses for the editorial process.

The result can be catastrophic for the aca-demic world. In 2007, one Danish research council demanded that the journals it supports should publish their articles for free after one year after publication.

This mandate had serious consequences. One of the journals lost 25 per cent of its subscribers in two years. It had to cut its editorial expenses and reduce the numbers of pages by 20 per cent.

Not all journals get off that lightly. The researchers behind six of long standing journals chose to stop the journals; Danish researchers have lost journals established in 1866, 1914, 1955, 1967, 1969 and 1993.

This policy that was set for a few journals is planned to be expanded to all Danish and foreign journals with articles from Danish researchers. The government is working with plans to mandate all researchers to archive their manuscripts in public repositories. Those repositories will function as public-supported publishing in competition with the journals with paid subscribers. When the public sector offers manuscripts for free the competition with result in the same mechanism as mentioned earlier. The journals will miss income and many had to reduce their quality work and number of pages or had to stop publication.

Partly a planned destruction

The policy is dangerous because its conse-quences may be to destroy academic publishing. However, the policy is made by research libraries and has as one of its aims to weaken publishers.

The explanation is twofold. First, the university libraries are threatened by the technological developments when publishers deliver not only the journals but nearly everything in a digital format. Librarians no longer write on index cards, put journals on bookshelves, retrieve them from borrowers, keep track of loans, etc. Instead, they buy a large packet of subscriptions through a discounted deal. Therefore the policy is a way to maintain the existence of the libraries through building and running databases.

The other part of the explanation is that li-braries have an increasing number of journal subscriptions. The numbers of journals are proportional to the numbers of researchers and because of an increase in the numbers of researchers in China, Brazil, India and other countries, more research is done and this research has to be published.

Publishers try to have this research fi-nanced by their traditional customers in the U.S., Europe and Japan, and the rice in prices for this—and new digital services—is too much for research libraries.

In reaction, many libraries now require a model of open access called “author self archiving.” Through an international lobby, librarians have pushed for a requirement for researchers to archive their research in databases organized by librarians. With acceptance of this model, librarians could maintain a central role in the future.

At the same time the free manuscripts in databases should give a competition to the greedy publishers to have the subscription prices lowered. This is a well-known argument in the Open Access debate and mostly stated by the “inventor” of the “green” Open Access, Stevan Harnad.

Libraries are stronger than journals

It can be a surprise to see that the library sector is setting the policy on such an im-portant area in the academic world, but there is an explanation based on organizational matters.

At the universities the research library is a total service that literally has a cable through all departments. The libraries are not competing against each other—at least not that much—while the departments compete against each other. All parts of the library system have to work together because the idea is to have one common infrastructure system. A unified sector is stronger than a fragmented larger one.

The journals, the other part, are not an organic part of the universities as previously discussed. All parts of the universities have the advantage of the journals but they do not have ownership of them. They are not responsible to journals with editors from competing universities on their editorial board.

State Intervention Necessary

An international development

The development in Denmark is happening all over the world. The competition among universities has increased in the last decennium. The internationalization has increased and students often are encouraged to study at several universities (often abroad) to get an international personal network. Therefore the universities compete for students and their money.

There is an international competition for the best researchers and teachers to be more competitive, and the international competition for money is increasing not only for EEC resources but money in cross-national funding of research projects.

On the organizational level, the development against a managerial dominated university happens in parallel helped by reports from OECD and international conferences with this message. The political system in the EEC is built much more on central planning than the original decen-tralized academic cooperation; therefore much of the policy from EEC is centralized in its scope.

The research libraries are working interna-tionally in very strong organizations where many have a very articulated target to work with lobbies at an international level.

First, the American libraries got a very nar-row cooperation through the Association of Research Libraries and in 1997 the organization established SPARC as an organization with a strong focus on lobbying and fighting publishers. This organization has a European branch, SPARC Europe, founded in 2001as one of many public funded lobby organizations. One of them is Knowledge Exchange, an organization between Danish, British and Dutch lobby organizations.

These lobby organizations have been very successful in lobbying against the EEC and other international organizations.

Intervention is necessary but dangerous

Unfortunately, all the approaches mentioned pose a severe threat to high quality journals. None of the players mentioned will voluntarily change their policy. The consequences will be visible at different times in different areas.

First the small journals in the humanities and social sciences will be hit by the policy. They are often small because they focus on regional cultures and local societal conditions contrary to the STM (science, technology, and medicine) with their international approach. Often the journals are published in a native non-English language, too. At the same time the humanities and social sciences are the weakest sectors in universities because the managerial ideology often will favour practical business. The small secondary international journals will be hit by the policy second.

On the contrary, the big publishing houses will be strengthened by this development. When their competitors are weakened the large players will stand stronger. Only an intervention from the state can stop the worst consequences from occurring. Yet, this action will rob the journals of their academic freedom, possibly leading to a negative impact on their quality, and of course will be a thread to the academic world itself when the political system is so close to publishers. The political system can arrange its money to “kind” areas while more critical areas will be suppressed. In the editorial process the editors can make other decisions to please the paying hand rather than the academic truth.

About the author

Jørgen Burchardt is chairman of the Danish Science Editors and member of the board of the Danish Science Journalists Association. He is a researcher with many books about knowledge dissemination and business development. For more than 30 years he has worked as an editor of national and international academic journals. In 2001 he organized the first Danish peer-reviewed Open Access journal.

17. A Comprehensive Survey on Frequent Pattern Mining from Web Logs

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Abstract. Web usage mining is the type of Web mining activity that involves the automatic discovery of user access patterns from one or more Web servers. As more organization rely on the Internet and the World Wide Web to conduct business, the traditional strategies and techniques for market analysis need to be revisited in this context. Organizations often generate and collect large volumes of data in their daily operations. Most of this information is usually generate automatically by Web servers and collected in server access logs. Other sources of user information include referrer logs which contains information about the referring pages for each page reference, and user registration or survey data gathered via tools such as CGI scripts. In this paper we have surveyed various applications of web usage mining and analyzed their productivity.

Keywords: Web usage mining, World Wide Web, Data mining, Web mining

18. Carrier of Science Communicators in India: Present & Future

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Abstract. India is experiencing an extensive transmission of science communication activities. Government, Public institutions, Schools, Colleges, Non-government organization and a number of associations are actively spreading scientific knowledge not only via traditional media but also through specific forms of interaction with varied public. Knowledge about science & technology is inevitable in this modern hi-tech world. There is a massive demand

& vast scope for science communicator or person who popularizing science among the public or society or masses. Nowadays science & technology department, print & electronic media, NGO's, Environment institutions, Forest department, science communication centres etc. have huge demand for science communicators. Government, Science

& Technology department, education institutes are now setup the Scholarships, fellowships, training and courses to develop talented and skilled science communicators. In present time science communicators got key position in India and this shows that science communication field and science communicators will demandable in future. This paper aims to provide overview of the diffusion of science communication and science communicators in India illustrating its current development and future prospects.

19. Why communicate research to the public?

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Abstract. There is a global insurgence for communicating research to the public. But the very first question arises why communicate research to the public? Why public should know about research or S&T? Why scientists should spent their precious time in talking to or writing for the public rather than working on a new paper? Scientific research, scientists and the public show a very intricately woven relationship. Scientists cannot do alone their research without public support and the public cannot solve their problems without scientific interventions. Advances in scientific research and their implications on society are critically important in the modern information age. The results of research have a direct bearing on our socio-cultural and political life. S&T is confronting man at every step of life.

A greater demand for an increased access to the scientific knowledge by the different communities has been realised. People, whether literate or illiterate, are living in a world of science and technology and survival in this S&T age can be very difficult if they are devoid of scientific knowledge. Access to scientific information is the key to survival in this hi-tech world. Science communication protagonists are demanding scientists, in addition to communicating their scientific research to the peers, to communicate their research in a popular language to the lay populace – the ultimate consumers of research. In fact, communicating research or S&T advances to the public is the need of the hour and so scientists should play an active role here. Further, science communication can ensure transparency in the pursuits if scientific research and can help in developing consensus on controversial issues and can provide the direction in which science should march ahead. It can also do a lot in democratizing science.

A critical review of the problem 'why communicate research to the public?' is proposed to be presented in this paper highlighting and discussing the various factors which can only be addressed through science communication. Role of science communication in democratizing science is also proposed to be discussed in the present paper.

Keywords: Science communication, Need for research communication, Benefits of science communication, Transparency, Democratizing science

20. Metaphor as a Medium of Electronic Communication

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Metaphor, of course, is an essential component of poetic language. The central role of metaphors in science seems to ensure that science is open-ended, suggesting that conceptions of reality will always be open to change and interpretation. This study aims to examine some of the uses of metaphor in science communication and to provide a conceptual understanding on this topic. As we shall see, metaphor enters into the communication of scientific ideas and at times influences the formulation of scientific problems and the ways in which problems are conceptualized and approached. This paper specially deals with metaphor in electronic communication. The use of metaphors helps us understand new concepts, and the way that we talk about electronic communications is highly metaphorical.

For instance, the idea of cyberspace as a place is reinforced by the media as well as by the people who use electronic communication. And the people who communicate online frequently discuss aspects of cyberspace; what it is, where it is, when it is, and who its citizens are. Cyberspace has become then, a commonly used term for representing this system of electronic interactions. Thus we use the words, "cyberspace", "information highway" and "the Net" for electronic communications.

21. The use of Information Communication Technologies (ICTs) as a tool to advance science across cultures in multiple societies

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Abstract. The ICT component of Science Communication was brought into SAASTA with the aim of furthering the advancement of Science, Engineering and Technology (SET), and is aimed at investigating new, interactive ways of spreading awareness on SET that is not only tailor-made for a specific set of disciplines or sets of information, but to also communicate across cultures – breaching the demographic gaps, while considering sensitivities of all cultures. SAASTA runs programmes across many disciplines, including Public Understanding of Biotechnology (PUB), Public Nanotechnology Engagement Programme (PNEP) and HySA Public Awareness Platform (HySA PAP) and more, and the use of ICTs can further advance these programmes and aid them in reaching their objectives.

South Africa is a country with extremely diverse groups of people, cultures, languages and behaviours. Reaching and identified target audience with a very specific message has become an art in the present day, as mass-media messages falling on deaf ears are now a thing of the past. With certain types of ICTs, tailored to its intended audience, with the correct communication message attached, can be far more effective and cost-effective than mass paid media or “media buying”. This paper will investigate social media as a form of communicating science, as well as which new media are the most effective, what works and what does not and so on. It will also look at exhibitory, and how the game has been revolutionised. Static ‘poster’ exhibits only work in certain areas, but an interactive touch kiosk exhibit can work wonders for growing a young child’s enthusiasm in a particular field. ICTs allow the message sender to target an audience incredibly accurately and if the message conveyed is correct, ICT communication channels can and will be far more affordable and effective, as there is no longer the effect of casting a wide net hoping to catch only the intended few.

Naturally, advancing science does not end at South African border posts; South African science advancement also plays the global game. With so many cultural differences between the various nationalities, bridging cultural gaps are challenging for any communicator, let alone science communicators. This paper will showcase a truly remarkable project undertaken earlier in 2010 where SAASTA had to bridge the language and cultural gaps between South African science communicators and the Chinese public. An exhibit showcasing South Africa’s National Science Institutions was created and sent to Shanghai for the World Expo. Elements to be discussed will include, the background of the project, the necessity for it, the various and multiple challenges faced in its development – which included technical as well as translation and cultural challenges – and its performance in Shanghai. Another aspect to be discussed will be how to retrieve viewership data from this exhibit, and future ways to adapt it and use it within South African borders and in other countries across the world.

The various elements of this paper and presentation will cover: the correct use of websites in communicating science; technologies available and the application of these technologies; social media as a form of communicating science; growing social interest in science communication; international and national best practices; how it is done in other parts of the world; a look at the future; a comparison with the past; “hit” statistics with social media; exhibitory and how far it has come; and, what can be learned from using the incorrect ICTs for certain messages.

22. Science, Politics and the Media:
The Climategate Disputes in France

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Abstract. Science is increasingly part of the public domain: scientific controversies, previously well protected from the public eye by the tacit rules which organize scientific communities since the XVIIth century, are more and more open to public inquisitiveness. There is a growing interdependence between science and politics. Political decisions must rely on scientific expertise while scientific and technological options and choices are evermore subject to political bargaining. The debate on climate change and global warming is a good example of this new direction in science history (history of science).

This paper will deal with the most recent media events concerning the “climategate” in France. We shall start with the analysis of Claude Allègre’s L’imposture climatique ou la fausse écologie, which was published in February 2010 and triggered a number of responses of all kinds in the media. C. Allègre is a well known geophysicist and former minister of education and research in the last socialist government. His climatoskeptical views were already well known and widely discussed in the media but his book appeared as the last straw. The French community of some 400 scientists, as different from each other as the disciplines and the specialities they represent, but all involved in the French branch (GIEC) of the IPCC, published a petition against the «lies» of Claude Allègre, asking their minister, Valérie Pécresse, as their employer, to reassert the scientific status and the seriousness of their work and to prevent further public diffusion of additional «lies» by Claude Allègre and his colleague, Vincent Courtillot. Allègre‘s crime according to the signatories of the petition is to have published under the cover of scientific background without peer control. This petition, in turn, was followed by numerous reactions in the media, generally condemning this appeal for a political intervention in what was considered by most journalists and popularizes as a scientific debate between experts. The petition also showed the difficulty for these scientists, highly specialized in various fields, to accept their position as lay people in relation to each other’s narrow competence over this or that aspect. The general issue of climate change and global warming with its political overtones leaves them helpless within the public debate. Hence, this curious demand of the community to reaffirm the necessity of a clear cut separation between science and politics in order to recover an autonomy which would be provided by a politician! Such a move is contradictory as many debaters like Jean-Marc Lévy-Leblond or Benoît Rittaud have pointed out in the media. Bruno Latour’s position presented in Le Monde (22nd of May, 2010) is also ambiguous. Recognizing the impossibility to disentangle expert’s science from politics, Latour advocates for a new distinction between science and research. While the former is an area of undisputable facts prone to be popularized in a traditional way (reinforcing autonomy and control of the scientific communities on the public divulgation of «their» knowledge!), the latter integrates uncertainties within the field of scientific experimentation as well as within the field of political action. According to Latour, the «good» link between science and politics should involve a confrontation with uncertainties in both areas under the arbitration of the cautionary principle. How could the media deal with such a «proposal» which would radically change its role in the management of the relationship between science and society? It is within such a media turmoil that the journalist Sylvestre Huet from the newspaper Libération, published his response to Claude Allègre (L’imposteur, c’est lui, Paris Stock, April 2010) pointing out all the scientific mistakes and inaccuracies in the book in order to discredit the political argument of the geophysicist. The journalist is attacking Claude Allègre as a scientist with scientific arguments while the latter is dismissing these arguments by relying on the global political relevance of his argument against the anthropic origin of global warming. Within this paper, we seek to identify the scientific and political stakes of this strange controversy.

23. Different Perspectives on How Nations View Technical, Methodological, Legal, and Environmental Issues on the Inclusion of CCS in as CDM Project Activities

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Abstract. It is discussed at the international level regarding the eligibility of CCS (Carbon dioxide Capture and Storage) under the CDM (Clean Development Mechanism), owing to unresolved concerns. Among them, (a) non-permanence, including long-term permanence, (b) MRV (Measuring, Reporting and Verification), (c) environmental Impacts, (d) project activity boundaries, (e) the potential for perverse outcomes, (f) safety, and (h) liabilities are the areas open to dispute.

As for non-permanence, including long-term permanence, some parties have raised concerns over the risk of seepage from CCS projects over the crediting period and the risk of sudden, massive release of CO2 and the implications. Other parties, mainly developed nations, argue that the risk of non-permanence or seepage is a manageable risk.

As for measuring, reporting and verification (MRV), some parties argue that monitoring would add unmanageable complexity to the CDM and that the CDM institutional structures would need to be modified to accommodate CCS. Some parties argue that the technology and processes to provide accurate MRV for CCS already exists. As for environmental impacts, some parties argue that the lack of experience with CCS compared to current eligible CDM projects and the uncertainty surrounding risk of seepage make Environmental Impact Assessments (EIAs) challenging. Other parties argue that CCS project management measures and practices are developed to identify, address, and prevent the risk of seepage from CCS projects.

As for project activity boundaries, some parties argue that there are difficulties in defining the project boundaries if there are several different injection points from different project activities in different time frames. Other parties argue that project boundaries for the storage reservoir would be defined by the site characterization, including any potential seepage pathway, modeled CO2 migration path, and any potential secondary containment formations.As for the potential for perverse outcome, some parties raised over perverse outcomes of inclusion of CCS in the CDM relating to : i. CDM market implications; ii. increase of fossil energy production; and iii. subsidization of Enhanced Oil Recovery projects (EOR). Other parties tell that inclusion of CCS is not expected to significantly impact on CER markets in the short to medium term, with uptake in developing countries being gradual over time.

As for safety, some parties have raised safety concerns related to the inclusion of CCS in the CDM, notably in relation to the risk of catastrophic release of sequestered and stored CO2. Other parties argue that best estimates of seepage rates by geologists are well below levels that would cause any significant increase in atmospheric CO2 or risk to public safety.As for liability, some parties have raised concerns relating to the assignment of liability to account for emissions associated with seepage (or liability for non-permanence). Other parties consider that the modalities and procedures should require that proposed projects are in compliance with all relevant national laws and regulations for the deployment of CCS.

In this research paper, theoretical background on how different nations analyze the scientific fact - technical, methodological, legal, and environmental issues on the inclusion of CCS in as CDM project activities, based on different backgrounds.

24. Communicating Science–Making Europe: A Critical Analysis of Two Decades of European Commission's Science-Society Policy

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Abstract. From the mid-1980ies onwards many European member states started–although with very different intensity and developing diverse approaches–to put in place programmes and activities addressing science and society issues. Ranging from new forms and formats of science communication, over more interactive and dialogue oriented settings to public participation exercises, in each national context specific, culturally grounded sets of initiatives were developed. In this patchwork of diverse national science and society initiatives, the European Union entered the scene by the late 1990s as an important player. Since then the European Commission has been carrying out substantive survey research on science and society in Europe, has launched and supported numerous programmes funding research and actions in the domain of science and society, has issued numerous reports and policy statements, created science communication awards and many more. Through these activities the European Commission was aiming at supporting the formation and stabilization of Europe as a research area, as well as at creating favorable conditions for making Europe a competitive knowledge economy.

This paper aims at analyzing these European policies concerning science/society interactions over the nearly two decades. It will explore questions such as: How were these interactions between science and society imagined? Which forms and formats did they take? How were they discursively framed? What were the different expectations of the actors involved? And how did all this tie into different models of a future European knowledge society in a global context? Main issues discussed will also cover the changing visions of who would be these "European publics" to be addressed, of why people should understand technoscience, of who is supposed to communicate and actually what should be understood about science. Yet more importantly the question of how these framings of the "science and society problem" changed during the last decades, e.g. from understanding to awareness to engagement, how that impacts on the ways technoscience is integrated into contemporary societies and what future challenges are waiting in this domain will be critically addressed. The empirical basis of this paper will an extensive study of policy documents, programmes and action lines, evaluation reports and many more.

25. Problems in Using CITs for Science Communication in Less Developed Countries: A Study of South Asian Science Communication Discussion Forums

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Abstract. Phenomenal growth of the mobile telephony in the less developed world, particularly in India, much as the same way as that of the Internet in late 1980s and early 1990s, has changed information and communication technologies (ICTs) in the 21st century to communication and information technologies (CITs). But the relationship of information and communication is getting even more symbiotic.

Even when ICTs are reaching remote corners in less developed countries, their potential as a powerful tool for science communication activities largely remains untapped. The depth of ICTs for science communication activities in India is very limited, thanks to systematic decline and neglect of a few other components of national information suprastructure and infrastructure. One example of this can be secondary and tertiary education policies and infrastructure that has increased info- and digital divide within the country leading to a communication divide. The divide between elite and non-elite institutions in communication and information potential is also increasing. But looking at a rosy side of the picture, ICT tools and applications have the potential to bridge many of these gaps. Discussion forum is an example of one such tool that can be used without great sophistication or infrastructure at users' level. But, discussion forums as tools for science communication are few in south Asian region in general, and India in particular, and many of those that have been launched are not working anywhere near their optimum potential.

A study of a few science communication discussion forums in south Asian region is being carried out and preliminary results show that most of the resources are used simply for sharing of information, while discussion on science communication–the primary purpose of any such forum–remains neglected. Problems associated with discussion forums are also discussed, along with methods and ways by which their efficiency and effectiveness for science communication is increased.

26. Scientific Citizens: Understanding Science Movements and Democratization in India

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Abstract. The proposed paper is based on several case studies of science movement organizations (SMOs) in India. These case studies include some of the more active SMOs–Kerala Sashtra Sahitya Parishad (KSSP), Marathi Vidnyan Parishad (MVP), Delhi Science Forum (DSF), Eklavya, and Bharat Gyan Vigyan Parishad (BGVS)–all integrated under an umbrella network known as the All India People's Science Network (AIPSN). Based on primary as well as secondary data collected from SMOs, this paper attempts to (a) portray the life cycles such as emergence (ideological roots), growth (activities and diversification, if any) and decline/renewal of these SMOs, and (b) analyze the said phenomenon from the vantage of social movement perspective. Science movements in India might have started as a discursive movement where activism started with a discourse and later on manifested in some form of social mobilization. But as the analysis of this study shows discursive formation is not an encompassing framework to justly explain the movement. It fails to do so particularly because of the grassroots activities of KSSP and emergence of pan-India organizations like BGVS that indulges in popular social mobilizations. The analysis indicates that of late, the science movements in India have taken the shape of social mobilization. At the same time it further indicates that science movements have grown beyond the conventional social movement framework, i.e. from mobilization to institutionalization. The emergent institutions have not culminated as the end-processes, rather make an intermediary phase, beyond which some of these SMOs have become dormant, some have started declining, some have withered away making way for new institutions and some have emerged stronger by realigning themselves under larger umbrella organizations. In the process the movement renews itself, as new SMOs have also emerged. But at the same time it is observed that the movement has lost its original radical teeth, spontaneity and focus. More of it have come under the influence of the government and have shifted their areas of focus (to literacy, environmental awareness and even rehabilitation and resettlement issues). Hence, science movements in India now have acquired more the hues of "social–activism" (not that of pure science as it was earlier). The paper is one of the pioneering works on public communication of science and technology in contemporary India, through which attempt has been made to identify science with social criticism/activism and to perceive the same through social movement perspective. By studying science as a means of social criticism and social activism the paper forges a strong link between science as a social institution and contemporary social processes in India.

27. Birds Eye View of Science Communication

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Abstract. History of science is the story of mans progress in understanding the world around him in gaining control over the forces of nature. Right from the ancient scientists in dawn of recorded history, we try to bring the history of science from pre historic age to today's race for space, information technology and nano-science.

Keywords: History, Science, Development, Discovery, Communicate

Introduction

One of the most important contribution in mans progress has been perfecting the communication system by which a constant inter change of knowledge is brought about. The early men were able to communicate with one another only through the use of signs. Then came the development of language and writing, by means of which men could express an infinite variety of concepts and also transfer them from one generation to the next. The centuries that followed, saw the rise of other forms of communication ,printing, type writing, photography, telegraph, telephone, sound recording devices, radio, television, radar, facsimile transmission, micro filming , internet, mobile communication and so on.

Science is not always contained merely to learn about the world, and its application to industry (technology) it is greatly concerned with modifying it as far as possible. We shall never know when this never ending task began. The word science which we use today is a comparatively new word in the English language. Man's greatest scientific discovery, the use of fire dates back to pre-historic time. Importance of writing in the development of every other branch of knowledge can never be ruled out.

Science communication is a discipline that has very rapidly developed in theory and practice since 1995. A good communication between science and society leads to the development of scientific culture which can be utilized to solve global, regional, physical and social problems. Good science communication can help in the economic, cultural and social progress and overall well being of the global society.

Bird's Eye View of Science Communication

Ancient science

We can date back man's greatest scientific discovery, the use of fire and use of language to communicate to pre historic period. In this period man learnt to make some tools, which enabled him to survive and win mastery over other creatures. From the dawn of history, sun-the source of heat and light for earth has been worshipped as God. The movement of heavenly bodies like sun and moon may be recorded as the earlier scientific observations. The early observers impressed by the regularity with which they swept the sky and earlier calendars were based on the movement of moon. 4236 BC may be recorded as the earliest fixed date when first lunar calendar was developed. Later on for more accurate calendar were developed based on rising star called Dog Star. We can say that science of observation started with priests who can be called Priest-Scientists. These priests' scientists were anonymous. Both, Egyptian and Babylonian developed number system.

As the time progressed, the Egyptian architect-Physician 'Imhotep" designed the step pyramid in 2980 BC. His contemporaries had knowledge about medicine and surgery, the EDWIN SMITH SURGICAL PAPYRUS is the oldest scientific document written on papyrus and rolled up in the form of a scroll. 450 BC Hippocrates is known as father of medicine. Among primitive people medicine, magic and religion all went together. Babylonian had knowledge of Botany as well because they were familiar with date palm. Ancient Hebrew was more eager to know the relation between man and god rather than man and surroundings.

Early Greek thinkers were keen to find what the world is made of? To early Greek thinkers what we call today science was only a part of philosophy. It is only embracing search for wisdom. It was a religious cult philosophical school and a political movement. Pythagorean brotherhood was one of the most important groups that influenced the development of science in Greece. Pythagoras was founder of this group. He travelled widely. He set up a philosophical school whose members were bound by a vow to follow religious rites prescribed by which it remained powerful till 450BC. Pythagoras Theorem still appears in the geometry textbooks all over the world. Plato has been impressed by the Pythagorean belief in the importance of mathematics as the key for understanding the universe.

In fourth century BC, Greek philosophy reached its peak with Plato, Aristotle and their followers. Their ideas and metaphysics and ethics influenced the development of science. Socrates, 399BC was the creator of scientific method: inquiry, dielectric and conclusions. Plato, 347BC was one of the accomplished mathematician and a philosopher. He introduced logic into study of mathematics and made the way for Euclid in the next century. Aristotle was the student of Plato, he introduced the concept of diagrams, reviewed and criticised the previous knowledge and gave his own observations and opinions. Aristotle's work on biology in which he described life and breeding habits of 540 species of animals is very close to modern scientific method.

Aristotle reigned as supreme in the scientific matter even up to two thousand years after his death. The errors of Aristotle in physics and in astro physics held up the scientific progress till seventeenth century. Newton demonstrated that forces operating between heavenly bodies and that which makes the apple fall on ground are same.

Middle age science

From seventh century Islam religion founded by Prophet Mohammad played a great role in transmitting knowledge. Followers of Prophet spread their master's knowledge, by ninth century Arabs become the standard bears of scientific knowledge. It lasted from 900-1100 AD. The number system which we use today, Hindu-Arabic system derived from Al-Kwarizmi (ninth century) from Hindu mathematician of India. It originated with the Hindus and was carried to the western world by the Arabs. It fits into the most of our commercial and technical needs very well. Hindus also introduced the concept of negative numbers. Persian born physician Rhazes classified substances as animals, vegetables and minerals, a classification which still prevails in day to day dialogue. He was the first person to distinguish between small pox and measles.

One of the great Arab physicists Alhazen, his main contribution was the treasury of Optics, he worked out laws of reflection, atmospheric refraction, theory of vision. Eminent physician Avicenna was the author of Canon of Medicine, its translation became the famous text book for Western Europe for several centuries.

By the end of twelfth century, translations in Latin were available to European scholars. Greek work was translated into Arabic and Arabic into Latin. In the middle age advancements in pure sciences were comparatively insignificant but application of science to industry started developing. Glass making, iron foundries, paper making, printing press, marines/compasses, gun powder to be used in warfare. There was some of the outstanding industrial development. The first complete book printed from movable type of printing press was an edition of bible known as Gutenberg Bible 1455 AD. The importance of printing press in Science communication is to involve masses in scientific culture, to create an awareness of technological revolution which 20th century had witnessed and an attempt to achieve 'need to know" type of awareness.

In the Middle Age Science was linked to traditions. The ninth and tenth century it was predicted that the year 1000AD would mark the end of the world, but the calamity did not arrive. By the end of twelfth century the language barrier has been crossed, and Greek and Arabian scientific work has been translated to Latin. West came in contact with east, their literature, philosophy, science, architecture, art and industry. The growing thirst for learning resulted in setting up of universities and cathedral schools which were influenced by religion. The incorrect scientific views were hardly challenged. Aristotle, Ptolemy and physicians were supreme authorities. This view point was entirely hostile to spirit of free investigation.

In the thirteenth century, Robert Brown (1214-94) challenged the restriction for free investigation. He developed the science of experimentation. He was the first to suggest the use of lens for spectacles. But he is today remembered more popularly for the invention of gun powder. He was ahead of his age, he predicted horseless carriages, ships with sail, flying machines, and machines to lift weights, and fortunately we are using all these things today.

Progress in science comes from communication and criticism of ideas and theories. In the seventeenth century for scientists and philosopher's income and support came from other sources, they had to struggle hard to communicate with each other .This lead to development of scientific societies. Probably the earliest scientific society Secretornm Naturae, founded in Naples in1560 but it was abandoned for the fear of magic and black art. Another Italian academy was founded in Rome in 1603 Accademia dei Lincci. This was more respectable and its modern version still exists today. These invisible colleges were more in number in England during seventeenth century. Robert Boyle was a regular user of it at the one at oxford. These invisible colleges had no building, no faculty, no students, no resources and no regular funding. They were informal association of brilliant men anxious to share and compare thoughts, ideas and observations. The humble beginnings of invisible colleges led to the development of Britain's famous Royal Society in about 1645. This society flourishes today also. In March 1665, the society began the publication called The Philosophical Transaction of the Royal Society. This and the French JOURNAL DES SAVANTS are one of the few oldest journals published. With the founding of Royal society the science became fashionable, many rich noble men, dressed up well, attended the theatre to watch a 'show'. They observed the spectacular experiments in each weekly meeting. Royal Society focussed on experimental demonstrations [9]. The evolution of scientific societies had the most beneficial effect on the process of careful observation and experimentation, acute criticism of contemporary scientists had to be faced. They learnt the advantages of selfless cooperation among each other to find out the scientific truth.

New age science

The period of 1660AD to 1700 AD may be called the classical period of microscopy. The achievements made were unsurpassed up to nineteenth century. In 1672 Newton reported to Royal Society his findings on which he was already working and an Era of Newton began. Newton's Principia was published in Latin. In 1669 he was also elected as one of the eight foreign members of French Academy of Science. In his later years of life, he had a quarrel with noted mathematician Leibnitz over calculus, but Leibnitz method of writing was better so it has been adopted. Newton system of universe remained uncontested for more than two hundred years.

One of the Newton good friend and learned disciple, astronomer and mathematician Edmund Halley is best remembered for the accurate prediction in 1704 of Halley planet which bears his name. Halley's' chief contribution was the "estimate of the degree of mortality of mankind" which laid the foundation of life insurance business, life tables were drawn. His wife was devoted to him but was complaining against him for dissipating family fortune in useless scientific experiments, expedition and publication. He also intended to publish Newton's Principia with his own expense.

The period of 1765 -1815 may be called as age of chemistry; Lavoiset has been called the Father of Chemistry. He published Elementary Treatise of Chemistry, and Methods of Chemical Nomenclature. He and Joseph Priestly were sympathetic towards French Revolution. Joseph Priestly's one of the discovers of oxygen published in History and Present State of electricity. Henry Cavendish performed great many electrical experiments but did not publish them; he thought them to be not as per his high standards. His laboratories notes were published by James clerk Maxwell in 1879. French military engineer Charles Augustine Coulomb made significant contribution in electricity.

Last of eighteenth century was the age of American and French revolution and Industrial revolution, that is substitution of machines for hands that led to mass production and factory setups. Scientific thinking was employed for solving industrial problems

The period of 1800-1900 saw a group of Britain scientists Faraday, Maxwell and Hertz and other making unifying generalization intimate connection between light, electricity and magnetism. Twentieth century enjoyed the fruits of discovery that light heat and radio waves are EM waves in the field of radio, TV, radar, mobiles etc. Concept of Ether was introduced and Maxwell's electromagnetic theory of light was based upon this hypothetical medium called Ether.

Law of conservation of energy is one of the great contributions of nineteenth century to the development of science. Up to nineteenth century a rigid distinction was made between matter and energy but the twentieth century scientist has demonstrated that matter and energy can be transferred into each other, and the era of atomic energy and atomic bomb began. Bombing of Hiroshima and Nagasaki in World War II has led to era sins and sorrows produced by science and technology. Achievements of the science dominated the twentieth century with the start of a debate whether science is our master or slave. The decade from 1895-1905 is often called a miracle decade. The scientific developments of this period were the culmination of centuries of thought. Brief mention of this discoveries and invention is given for physical sciences: aeroplane, astro-physics, electronics, atomic physics, radio activity, relativity, x ray tube and vacuum tube. Biological science: biometrics, bacteria, microscope, virus.

The miracle decade witnessed the establishment of philanthropic foundations like Carnegie foundation, industrial research laboratories. Nobel prizes in medicine, chemistry, physics and physiology were established and were first awarded in 1901, this had a powerful effect on scientific achievements. Just before the miracle decade, scientific and industrial progress to have come to stand still.

In 1905 a clerk in Swiss patent office, Albert Einstein published a paper on '"Special theory of Relativity" and higher physics was born. The most remarkable team of husband and wife is of Pierre Curie (1859-1906) and Marie Curie (1867-1934) for the discovery of radium; they received Nobel Prize in 1903 along with Becquerel on radioactivity. Marie Curie received another Nobel Prize in1911 on her work on radium. She died in1934 of pernicious anaemia. She was the eventual victim of the radioactive bodies she and her husband had discovered. This proved how dangerous these radioactive substances are when they are not shielded.

Role of Science and Technology in World War I and II

Before World War I 1914-18, the education of military men always was to teach them how to fight the last war over again and not how to fight the next one. Their education material was a three volume treatise by Karl von Clausewitz on war which was based on Napoleonic times. But the advances in science and technology applied to ordnance, explosives communication and transportation caused the old ideas to be fearfully outdated. The use of submarines had upset the cherished tradition of war. All explosive contained nitrogen. The new process, known as Haber's process to provide nitrogen in usable form was discovered. Chemists played an important role n chemical warfare by using dreadful poison gas.

The World War II represented the triumph of applied science, technology, engineering and industrial know-how and an age of atomic weapons with atomic bombs began. It was a scientist war and more particularly a physicist's war. In World War II the victory fell not on the side of strongest battalions but on the side of best scientist and engineers. Atomic bomb cut the war short and saved millions of causalities but it did not win the war. Scientist worked ceaselessly to perfect offense and defence warfare, their efforts bore fruits in the form of super tanks, magnetic mines, jet and rocket bombs, radars sea crafts, submarines snorkels etc.

In the United States scientist were organised under a government agency OSRD Office of Scientific Research and Development it was a part of War Production Board. Other nations too organised their scientists for war, the British established Scientific Advisory Committee to the British War cabinet, and Canada established National Research Council, the efforts of scientists and engineers transformed into war machines and weapons. War production became the biggest business with special emphasis on crucial war material like steel, aluminium, rubber and petroleum . World War II took millions of lives but it also taught men how to save lives , DDT, insect killing chemicals, antibiotics and penicillin developed in the war proved to be effective against malaria and typhus fever. An expected outcome of World War II was population explosion throughout the world. The techniques of preventing medicine such as spraying on DDT and Inoculation against communicable diseases and anti malarial drugs were also the cause of population explosion. Now the big question of producing more food for more population arose. And science of agriculture was developed to solve World food problem.

Perils of Atomic Age

It is often said that atomic age began in 1945 when atomic explosions took place in Hiroshima and Nagasaki in August 1945. The public at large came to realise how harmful these radiations are. Before this only a small number of scientists and technicians were particularly concerned about radiation hazards. The deadly radiation emitted by the atomic bomb proved fatal immediately for thousands of people. As weeks passed by thousands of in habitants of Hiroshima and Nagasaki sickened and many of them died, they were victims of atomic bomb disease. After more than a decade of dropping of the bomb, people showed delayed symptoms of radiation damage penetrating radiation had become a problem that concerned not only few but the all mankind. The atomic bomb was the chief peril that confronted man in the atomic age. International commission on radiological protection has been set up to recommend safe exposure limits for professional people working with radiations. Roentgen is the unit. The people who received less than 100 roentgens of radiation were not sickened by exposure. This is a rough yardstick for estimating how many people will survive in future war after an atomic attack. The wisp of the bomb cloud that formed over Hiroshima after the explosion on 6th August 1945 floated around the world and were detected over the United States also.

After the atomic bomb explodes there are three types of fallout: local, troposphere and Stratospheric. Local fallout occurs within hours after the blast and comes to Earth within i distance of several hundred miles from the bomb site. Troposphere fallout has a wider distribution, it may take place over a period of several weeks, radioactive fragments travel thousands of miles. Stratospheric fallout occurs, the radioactive particles push into the stratosphere above the Earth surface and the fragments remain suspended for very long periods of time and fall to earth very gradually, this fallout is global in extent.

Uncertainty in Science

Science in nineteenth century appeared to be materialistic; scientists had cast of ties with philosophy. In the twentieth century the situation changed with Einstein's epoch making theory of relativity followed by the principle of uncertainty. Modern science does not speak with certainty. Its tone has become tentative, relative and uncertain. The field of higher physics was born. Physicists have to believe in impossible, invisible and uncertain. They had to perform hypothetical experiments and philosophical enquiry to solve the scientific problems. The serious problems of uncertainty in science were highlighted by German physicist Werner Heisenberg in the form of uncertainty principle.

We have come to realise the true limitations of science and have led us to the question: what is the Absolute Truth?

Control of electrons, the invisible negatively charged particles led to the development of electronics which revolutionised our livings in every corner of the world. The journey started with the electronic tubes followed by transistors, LSI, VLSI etc. Invention of transistor earned the Nobel Prize in physics in 1956 for Bardeen, Brattain and their co-workers. During first half of the 20th century, electronic circuits used large, power hungry and unreliable vacuum tubes. In 1947 John Bardeen and Wharton Brattain built first junction point contact transistor. Frank Wanless described the first logic gates using mosfets in 1963. The Gaudin Moore observed in 1965 that plotting of the number of transistors that can be most easily fabricated on a chip. The incredible growth of electronics has come from miniaturisation of transistors and improvement in the manufacturing processes. As transistors become smaller, they become faster, dissipate less power and are cheaper to manufacture. This synergy has revolutionised not only electronics but also society at large. The twenty-first century is going to be the decade of nano technology.

Purpose of this paper is to highlight for the twenty first century living beings that they should not forget how differently people live before they learnt how to harness the power and set the forces of nature to work. Quest for knowledge and history of science shall continue to remain fundamental human right for any individual born on this planet. There should not be any racial, regional, social, cultural, language barriers. Moral and ethical values should centre on humanity. Burning issues like global warming, it is not bound by any regional, cultural or social barrier. It is bond to affect whites and blacks, rich and poor. This is not a regional or national issue, but this has been a universal issue. If all the countries of the world continue to release green house gases this will lead to permanent changes and the whole planet would be affected.

Action plan 2010 science for all

1. Promoting scientific temperament in the poorest of the poor in the developing nations.
2. Promoting and nurturing women in science popularization.
3. Science for sustainable development and formulate planes to tackle some of the large problems which the world is facing today.
4. Contributions made by science to the world economy in the areas of electronics, nano-materials, computer and IT and health are ongoing and need to be appreciated. Many contributions have benefited people in developed nation more than those in the developing nations.
5. Science popularising should focus on energy and environment, health and economic development.
6. Develop and formulate an action plan for future, initiate new mechanisms of cooperation to carry out the action plan.
7. Knowledge should be free and accessible to all without copyright.
8. Storytelling and puppet shows to impart scientific knowledge to the illiterate.
9. Screen interactive CDs on environment space universe ecology etc.
10. Organise science and book exhibitions.
11. Use over head projector and slide shows to promote kitchen gardening, horticulture, fish production, organic farming bee keeping, solar cooking, water shed models to rural poor.
12. Create awareness amongst rural poor students about eradication HIV /AIDS , smoking
13. Retired scientists, teachers, professors and executives from MNCs may be invited to share their thoughts, feeling and their life journey, success and failure stories among generations.
14. Media persons to be encouraged and provided some subsidy to produce films on renowned scientists like Aristotle, Pythagoras, Einstein, and Newton etc.
15. Street play and songs, public movies, may be used to create awareness on public hygiene, sanitation, rain water harvesting, disaster management.
16. Awareness camps for removal of superstitious beliefs.
17. Industry –institute interaction as a part of science education curriculum.
18. Scientific knowledge should reach the poorest of the poor in the remotest corner of the world.
19. Principle of non-violence, peace, simplicity and universal cooperation is to be transferred to future generations along with scientific knowledge right from childhood.
20. Efficient management of time and resources available to every individual born on this earth is to be taught.

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28.Science Communication through Community Science Centers

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Abstract. Hands-on Science is a unique approach of learning and teaching science to the children and students. The due importance of practical working has been given in teaching learning process. Involvement of children in actual working practicals, making working or non working models charts or involve into making chemical changes has been given more importance for generating curiosity. The model presented here is one such effort for involving children and public into activity based science learning and removal of superstition. Unique scheme of setting of community science centre in public private partnership has been evolved out and put in practice. Presently Eighteen science centers have been established; communicators are trained and continuously supported for carrying outreach activities through experiments at grass root level. Nearly nine thousand activities have been carried out at various places in last three years. The details are given in the full length paper.

Preamble

Science and Technology have played an important role as a tool of Socio-economic revolution hence development of science and technological capacity and its application have become an important and inherent part in the planning process.

Application of Science and Technology as a modern tool for Socio-economic revolution is very much required in the interest of all round and speedy development of the state. The state has undertaken various efforts through five year plan for equal. Multilateral and speedy development by using latest technology in the fields of Agriculture and its dependent industry, Engineering industry, Transportation & Communicators, Irrigation-Construction, Environment & Rural Development, Public health, Medical science & Education, etc.

Development of Scientific temper and scientific attitude in daily life among the people are very much important for Socio-economic development of the citizen of the Gujarat state. It is also important and very much required to create awareness among the people about removal of prevailing superstitions from the society through scientific approach so that Socio-economic development can take place.

Necessity of planned campaign in different regions of the state is felt for maintaining and increasing the continuous efforts as one of the option for creating awareness among the people. With an objective to accomplish this work, the state government feels it essential to set up and maintain the structure of community science centres covering the whole state. In context of the said requirement, establishment of community science centres of various levels in the state is considered through public private partnership.

Functions and Duties

Functions and duties of regional / district level community science centre shall be as following:

Regional level

1. Execution of all the activities as mentioned in the functions of district level community science centre at headquarter and nearby area.
2. Development of activity modules of new science and its awareness programmes and providing the same at district level centres.
3. Organizing training / seminar / lectures at various stages to train the communicators of district level.
4. Keep updated with scientific activities of other state and transferring the same to district centres.
5. Getting quarterly information of the activities of the district centres and providing necessary guidance. Making efforts to boost-up their activities.
6. Separate planning of activities for district centres for each quarter. Execution and coordination for continuation of the activities in district centres as per said planning.

7. Coordination of district level activities in the districts where science centre does not exist. To provide motivation and encouragement to the interested organizations of the district.
8. Publication of books and magazines which develops scientific temper.

District level

1. To organize scientific activities considering students of different age group, women and common people at community science centre and rural places of different talukas.
2. To establish science clubs involving schools and different agencies.
3. To organize popular lectures / science dramas / street plays or other programmes regarding superstitions removal.
4. To provide scientific guidance about the natural occurrences like earthquake, eclipse, cyclone, astronomy, etc.
5. Programmes like Quiz, Elocution competition, Science Exhibition, science lectures, science related different competitions, celebration of the events related to inventions and inventors etc. shall have to be executed through science clubs.
6. To organize awareness programmes for healthcare, food and nutrition, diseases and resistance power etc.
7. To organize programmes regarding soil conservation, water harvesting and management, environment, etc.
8. Entrepreneurship development and training according to local needs.
9. To organize awareness programmes regarding agriculture and organic farming.
10. Special awareness programmes for the rural and tribal community may be organized.
11. To spread awareness through video van programme.
12. Other scientific programmes, lectures, demonstrations may be organized.
13. All the Planning may be done in contact and in collaboration with respective regional community science centre.
14. Programmes conducted through application of EDUSAT may be done in contact with GUJCOST.
15. To demonstrate video films about scientific activities.

Financial assistance provided by GUJCOST

District level community science centre

Table 1. Financial Assistance to DCSC

	Capital Grant (Rs.)	Recurring Grant (Rs.)	Total Rs.
First Three Years	1,25,000 (25%)	3,75,000 (75%)	5,00,000
Forth Year and afterwards	75,000 (15%)	4,25,000 (85%)	5,00,000

Regional level community science centre

Table 2. Financial Assistance to RCSC

	Capital Grant (Rs.)	Recurring Grant (Rs.)	Total Rs.
First Three Years	1,87,500 (25%)	5,62,500 (75%)	7,50,000
Forth Year and afterwards	1,12,500 (15%)	6,37,500 (85%)	7,50,000

Advisory committee

1. Advisor, GUJCOST / Representative
2. District Education Officer / Representative
3. Principal, District Institute for Education and Training (DIET)
4. University Dean of Science Faculty / Principal of the engineering / polytechnic college nearby.

5. Director of the district institute involved in the activities of rural development / Representative.
6. Superintendent of the Civil Hospital / Reputed Doctor.
7. Manager of the District Industry Centre / Representative.
8. District Planning Officer / Representative.

Building and Equipments

Building

Following shall be minimum requirements of building for community science centre at district or regional level.

Regional level. It is essential to have an independent building which can accommodate the following. Laboratory room-4 (Physics, Chemistry, Biology, Maths), Laboratory equipped with audio-visual equipments -1, Workshop-1, Museum room-1, Lecture room-2, Library room-1, Office room-1 etc.

District level. It is essential to have an independent building which can accommodate the following. Laboratory -2, Lecture room-1, Mini Library -1, Museum room-1, Office room-1, and if possible then workshop-1 etc.

Equipments

Regional level.

1. All equipments for experiment up to the higher secondary level.
2. Computer with internet facility.
3. Multimedia Projector-1, Over Head Projector-1, Slide Projector-1.
4. T.V, V.C.R., Screen, Radio, Tape, Sound System.
5. Essential equipments for workshop.
6. Museum with 40 to50 working models.
7. Library having the reading facility with 40 to 50 magazines and 3 to 4 thousands books.
8. Essential furniture for laboratory.

District level.

1. Equipments for experiment up to secondary level.
2. Multimedia Projector-1,
3. Over Head Projector-1, Slide Projector-1 and screen.
4. T.V and V.C.R., Sound System.
5. Museum with 25 to 30 working models.
6. Library having the reading facility with 20 to 25 magazines and about 1000 science related books.
7. Mini workshop or Essential equipments.

Operational Structure of Community Science Centres

Regional level science centers

Table 3

No.	Designation	Qualification
1.	Chairman (Honorary)	--
2.	Science Communicators (3)	M.Sc. or B.Sc. with 2 years experience
3.	Assistant (1)	Std-12th pass
4.	Hamal (1)	--

District level science centers

Table 4

No.	Designation	Qualification
1.	Chairman (Honorary)	--
2.	Science Communicators (2)	M.Sc. or B.Sc. with 2 years experience
3.	Assistant (1)	Std-12th pass
4.	Hamal (1)	--

Purchase Committee

1. Advisor, GUJCOST / Representative
2. Chairman of the Community Science Centre / Vice Chairman / Coordinator.
3. Trustee of the trust governing community Science Centre.
4. Principal / Representative of the Science / Engineering / Polytechnic College / Secondary School nearby.
5. Principal / Representative of the District Institute for Education and Training (DIET).

Subjects of the Programmes

Popular lecture series / workshop / seminar

1. Astronomy
2. Agriculture, Horticulture, Organic Farming
3. Food and Nutrition and Preservation
4. Mathematics
5. Rural Technology
6. Public health, healthcare
7. Disaster Management
8. Environment
9. Biology and Biotechnology
10. Physics
11. Medical Science
12. Nano Science and Technology
13. Chemistry
14. Water Resource Management
15. Oceanography
16. Soil conservation and Management
17. Space Technology and Application
18. Earth Science
19. Electronics
20. Information Technology
21. Energy
22. Mathematics Model Workshop
23. Fun with Mathematics/Physics/Chemistry
24. Mathematic show
25. Self maid equipment workshop
26. Production of Scientific Toys
27. Electronics workshop
28. House hold electronic equipment Workshop
29. Water harvesting, roof water harvesting , farm pond and check dam
30. Introduction of herbal plants and preservation awareness
31. Science school
32. Origami workshop
33. Industrial work exposure
34. Research Paper reading Competition

35. Scientific career seminar
36. Formation of study groups
37. Posters/Painting/Easy Competition
38. Science Drama Competition
39. Air and water pollution.
40. Book/CD/Magazine Demonstration
41. Nature camp
42. Science Quiz/Science Seminar/Science Project Competitions
43. Awareness programmes for superstitions removal
44. Other Scientific Programmes

Community programmes & communicators training

1. House hold electric equipment workshop
2. Water harvesting, roof water harvesting, farm pond and check dam
3. soil testing workshop
4. Water Testing Workshop
5. Awareness programme for superstitions removal
6. Food adulteration testing workshop
7. Awareness programmes about AIDS
8. Awareness programmes about energy consumption/un conventional energy sources
9. Health camp and Awareness programmes
10. Entrepreneurship Development
11. Programmes of organic farming
12. Introduction of herbal plants and presentation awareness
13. Other community based Scientific programmes

Celebration of scientific days

1. World Wetland Day (2nd February)
2. National Science Day (28th February)
3. World Forestry Day (21st March)
4. World water Day (22nd March)
5. World Meteorological Day (23rd March)
6. World health Day (7th April)
7. Astronomy Day (21st April)
8. Earth day (22ndApril)
9. International Thalassemia Day (8th May)
10. National Technology Day (11th May)
11. World Telecom Day (7th May)
12. International Biodiversity Day(22nd May)
13. Environment Day (5th June)
14. World Population Day (11th July)
15. Ozone Day (16th September)
16. World habitat Day (1st October)
17. Wild Life Week(1st-7th October)
18. World Space Week (4th-7th October)
19. National Disaster Reduction Day (10th October)
20. World food Day (16th October)
21. World Science Day for Peace and Development (10th November)
22. World AIDS Day (1st December)
23. National Energy Conservation Day
(14th December)
24. Birth Anniversaries of Scientists

Video van programmes, awareness programmes of superstitions removal

1. Video van Programme / Exhibition and Demonstration of Posters and scientific experiment film CD.
2. To create awareness about superstitious.

Science club related activities

1. Establishment of science clubs in school and to form a network of science clubs.
2. To provide literature of math's and science and other equipments to science club.
3. To organize workshop to guide students / teachers.
4. To organize competition of scientific programmes for the students / teachers members of the science club.

Minimum yearly programmes to be conducted by Community Science Centre

Table 5

Sr. No.	Type of Programme	District Community Science Centre	Regional Community Science Centre
1	Popular Lecture Series/workshop/Seminar	9	12
2	Community based Programme	6	9
3	Celebration of Scientific Days	6	9
4	Science Exhibition	5	7
5	Science Quiz /Science Seminar/Science Project Competition/Other GUJCOST Programmes	5	5
6	VIGYAN SAFAR/Video Van Programmes, Programmes of Scientific awareness about superstitions	30	45
7	Demonstration of science Experiments (Science School)	40	40
8	Establishment of science Club in school and activities	50	100
9	Communicator's training	-	02

Community Science Centres (CSC) last three years activities

Table 6

Name and Address of Community Science Centre	2007-08		2008-09		2009-10	
	No. of Programs	**No. of Participants**	**No. of Programs**	**No. of Participants**	**No. of Programs**	**No. of Participants**
O.V.Sheth Regional Community Science Centre, Nehru Udyan, Racecourse, Rajkot-360001	168	31440	192	21,216	477	47,000
Community Science Centre, Aarti Society, Atmajyoti Ashram Road, Subhanpura, Vadodara-390023						

206	30,134	189	22,272
264	59,995		

Kalyan Regional Community Science Centre, BhavnagarPlot No. 2232,
13/A, Daxinamurti Society No.-2,
Hill Drive, Phulvadi, Bhavnagar

224	40,845	361	98,284
422	83,335		

M.D.Mehta District Community Science Centre, Darbargadh, Dhrol-381210,Dist. Jamnagar			
561	45,801	551	135,400
483	88,741		
Nisarg Community Science Centre, 61/3, GH-Type, Nr. Swaminarayan Mandir, Sector-23, Gandhinagar			
118	40,990	181	32,689
205	59,384		
Pramukhswami District Community Science Centre, Badoli, Ta.- Idar, Dist. – Sabarkantha			
45	44,935	59	59,138
143	48,930		
Girdharbhai Sangralay District Community Science Centre,Museum and Balbhavan, Amreli-365601			
114	44,343	186	18,204
163	20,794		
District Community Science Centre, Chaparda, Ta. - Visavadar, Dist. Junagadh-362120			
284	56,228	308	55,939
415	75,569		
C.C.Patel Community Science Centre, Vallabh Vidyanagar, Dist. Anand 388120			
47	7,075	62	5,987
117	22,000		
Jay Bharti District Community Science Centre, Sir Sorabji Training College Campus, DIET, Chok Bazar, Surat-395003			
131	35,141	227	66,889
155	81,086		
Dr. Homi Bhaba District Science Centre, J. P. Marg-1, Dudhrej Road, Surendranagar			
20	24,578	26	27,287
125	28,090		
District Community Science Centre, PalanpurBeside, Kisan oil mill, Laxmipura, Palanpur 385001. Banaskanta			
70	18,183	80	25,889
177	32,800		
Punaba District Community Science Centre, C/o Adarsh VidhyaSankul, Patan-384265			
42	48,422	46	18,028
110	24,083		
Shree Sahajanand Swami District Community Science Centre, Chhaya C/o Shree Swaminarayan Gurukul, Chhaya Main Road, At-Chhaya, Porbandar-360578			
113	28,471	159	30,983
109	19,341		
Prayosha Community Science Centre, Dang Swaraj Ashram Ahwa, Dang-394710			
63	29,088	99	21,245
160	25,127		
Community Science Centre, Swami Vivekanand Vidyavihar, Navu Sankul, Opp. Kumar Petrol Pump, Dakor Road, Nadiad, Kheda			
25	3,891	41	15,422
-	-		
Kutch Mitra Community Science Center Indian Planetary Society Bhal Bhavan, Khengar park Opp. Hamirsar talav, Bhuj-370001.			
-	-	111	
25,332	105	35,310	
Param Community Science Center Satyam College of Education Mahila B.Ed. College, Divyajyot Sankul opp. Pritam Socity-1 Bharuch-392002			
-	-	-	-
19	7,925		

Manthan Narmada Community Science Center Old Zilla Panchayat Building, Main Market, Ta-Rajpipla. Dist-Narmada

-	-	-	-
167	51,083		

Last three years records **Table 7**

Year 2007-08 2008-09

No. of	2009-10		
Programs	2,231		2,878
3,816			

Beneficiaries 5,29,565 6,80,204
8,10,593

29.Analytical Study on Theories and models of science communication for Development

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Abstract. During early days, there was no science communication, as such. But as we understand it today, the technology, science and communication existed from the very beginning. There had been a number of turning points during the cultural evolution of man in India, from where we can mark the beginning of science communication, but it is very difficult to pin point a single incident being origin of Science Communication in the country. The evolutionary trends of science communication evolved so far in the country, and the efforts are on to find out newer and innovative modes and ways to communicate and popularize science more effectively and in an interesting manner. Undoubtedly, science communication activities and programmes have progressively developed in India, in terms of quantity. There are science magazines, TV programmes, radio programmes, large number of publications, field activities, exhibitions, interactive programmes, websites etc. to popularize science among people and to create awareness about the science needed for life.

Science communication is integral to every aspect of modern life. Despite generally favorable public attitudes about science, technology, and their benefits, however, tensions continue to emerge at the intersection of core human values and certain scientific fields—from human embryonic stem cell and global climate-change research, to the teaching of evolution (Nicholas, 2000). Increasingly, this tension has interfered with scientific progress, the quality of science education, and the broader ability of the scientific enterprise to fully serve the needs of society.

Understanding of science and technology is an essential pre-requisite for making wise choices in the acquisition and utilization of knowledge resources, which are to be fully deployed towards human development and welfare. Attempts to bring the benefits of science to society require a certain threshold of capacity to understand science and its implications, and to recognize the daily opportunities to make science work for people.

There are many theories and models in science communication to create awareness and to educate the knowledge on science and technology to the public. These theories and models explain the ways of communication and strategy but don't explicate the message of communication. Science and technology communication are a pervasive presence in our lives. The way we work, communicate with one another, stay healthy, and play are all profoundly influenced by the results of scientific inquiry (Friedman, 1999). In such a world, increasing the public's understanding and appreciation of science and technology is of vital importance. The Science and Technology communication for rural people brings development in socio-economic growth of people which lead to development of nation.

This study is to be done to analyze various theories and models of science communication to understand the concept and its impact on people. And also this study helps to understand the essentialities of science communication for rural development. The traditional approach to dealing with science-society anxiety has been to try to increase public understanding of scientific discoveries and theories. Yet, many members of the public do understand the scientific issues and facts, but find them inedible, and thus, education alone may be an insufficient response.

30. Effectiveness of Science Communication vis-a-vis Evaluating the Various Interventions

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Abstract. Public communication of science refers to transfer of scientific information by a sender to a receiver in such a manner that both have a common understanding of the meaning and intent of the message. Communication involves many players such as the communicator, message, channel, treatment, audience and audience response. The basic objective of science communication is to lead to action. This objective can only be achieved when communicators ensure that their intervention is effective. Now, the question arises how to determine the effectiveness of communication intervention? Evaluation is the key to determining the effectiveness of public communication of science. Before taking a step forward in this era of Information and Communication Technology where we find unprecedented explosion of knowledge, it is deemed necessary for the various stakeholders associated with communication of science among public to first study the various initiatives taken by different agencies associated with dissemination or communication of scientific information among the client population. Some of them could be media communication, on – line communication, publication activities, direct communication, promotional objects and the like. Evaluation itself is not a step in itself, rather a continuous process to be conducted at various phases; formative evaluation, summative evaluation, process evaluation, product evaluation, context evaluation, impact assessment etc. The paper throws light on evaluation base and methods of evaluation for each of the above communication methods and also discusses about some of the research studies conducted in the area of evaluation of public communication of science. Mention is made regarding the methodologies used to conduct an assessment of communication needs, media use behaviour, effectiveness of various media and media – mixes, usability of websites, content analysis of print media, on-line media used for science communication. A considerable amount of work has been done in the area of evaluation with reference to science communication in the United States, Canada, some of the African countries too. The World Bank has an Independent Evaluation Group which caters to the evaluation needs of various groups. Coming to India, this area is still in its infancy and needs to be taken care of since resources are limited and priorities are to be set. All this can be made true with the efforts of social scientists, development communication experts, mass communicators, information technology persons who can be partners to the cause of evaluation in the field of science communication.

31. Use of statistical information by Indian journalists: An analysis of articles on scientific research in vernacular press

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Abstract. The news writing about scientific events specially where statistical data is involved is problematic for the journalists of the vernacular press where the languages used in the study and reporting are different. The basic aim of this study is to analyse, as to how the Indian journalists deal with statistical information and how they interpret matters of risk and probability. In simpler words, we aim at analysing the gap between the actual scientific information and the one which is reported in the local press. The study will consist of mainly two parts - selection and analysis of newspaper articles, and interviews with journalists and editors from the news section as well as science journalists. The first, qualitative part of the study explores the kind of articles in which aspects of uncertainty play a part. News coverage of scientific research is very diverse and found in all sections of news papers. Often the word research is also used referring to work in non-scientific settings. Articles and reports appearing in local press, connected to science will be explored for a span of one month. These writings will be analysed followed by a study aiming at finding the role of journalists - how do they select items, what problems do they encounter in writing about scientific research and what are their perspectives in dealing with themes like risk society, uncertainty, probability and statistics. The conclusions will be drawn after a dialogue with journalists, aimed at discovering ways and means for understandable yet truthful coverage of present-day scientific work.

32. New Wine must be put into New Wineskins: The New Key Word "Science Communication" has changed PUST Policy in Japan

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In Japan, there has been a long tradition of activities for Public Understanding of Science and Technology (PUST). While it is difficult to specify the starting point of such activities, we can recognize that one of the most important years was 1960 when the natonal science week was established. This may well have been the first such national science and technology week in the world. PUST activities mean what convey the pleasures of science to children. But you know those are top down activities. Such a long tradition of PUST in Japan has changed since 2005. The big change was triggered by a new key word "Science Communication." Although the concept of Science Communication has introduced into Japan since around 2000, it has had little influence till 2005. In 2005, the word "Science Communication" first appeared in the White Paper on Science and Technology 2004. It was an epoch- making event. Since then almost everything has changed. I recognized that one of most important things is a new name or word because people like novel movements and activities. I discuss about the transition from PUST to science communication in Japan. And I also show you our action plan for propagating science communication concept in Japan.

33. Engaging with Audiences who are Unengaged on Science

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Abstract. A key challenge for many science communicators, often overlooked, is how to reach out beyond those audiences who are already engaged with science, and get through to those who are unengaged or disengaged with science. Market segmentation research in Australia and the United Kingdom shows that these unengaged may make up about 35 per cent of the public – a not insignificant group of people. This presents a real challenge for contemporary science communication and engagement activities – how do you ensure that you are reaching and hearing from a full representation of the community?

Keywords: Public Engagement, Unengaged, Public attitude research

Introduction

Activities undertaken by science centers, research institutions, the science media and science communicators over the past few decades have, in general, made a significant contribution to raising awareness of science issues across society and increasing science literacy, at least amongst many people.

For there are still substantial numbers of the population, in all countries, who never visit science centers or research institutions, are turned off by science-based stories in the media, and are unengaged on science topics. But while we, as science communicators, collectively know more and more about the segments of the population that are 'switched on' or engaged with science, we seem to know precious little about those who are 'switched off'. Yet without a better understanding of the attitudes and values of these people, they are unlikely to be effectively reached with most science communication strategies.

Australia's Department of Innovation, Industry, Science and Research has undertaken a series of dialogues with recruited members of the public who are unengaged on science, to discover more about their interests and attitudes, sources of trust and information needs. Key findings are that unengaged members of the public have different values, different interests and are differently engaged about science and technology from those sections of the public who tend to be involved in most science communication activities.

So relying on data from people who engage in science communications activities, and extrapolating that across the broad population can be as misleading as taking the opinions and comments of extremist groups on issues such as gene technology or nanotechnology as representative of the broad society.

Indeed, one lesson from public engagement activities on these topics in Australia is that it is difficult to attract and maintain broad public interest in a debate being conducted between interest groups. This is particularly so when the debate is defined by polarised extremes of those passionately for or passionately against the technology; neither of which align well with the broad public interests in hearing a balanced account of the relevance of different applications to their lives.

And this relevance to one's life is doubly significant when seeking to communicate with the unengaged, as the findings have revealed.

Better Understanding the Segments

While different countries will have different attitudinal or behavioural segments of the public in relation to how people relate to science and technology, the findings of two recent studies serve well to show the types of audience segments that can exist.

A UK study undertaken in 2008, Public Attitudes to Science 2008 – a Guide, prepared for the Research Councils UK and the Department for Innovation, Universities and Skills, found five key segments [1]. These were:

1. The Confident: 20%

The most interested and most positive about science, most informed about science and most highly educated.

2. The Less Confident: 25%
Very concerned about change and felt that science and scientific development was out of control. They feel poorly informed about science. Nearly half were over 60, and this segment had the lowest level of education.
3. The Sceptical Enthusiasts: 12%
Had a positive outlook on life, liked learning new skills and had a wide range of interests. They were also positive about science. However, they were sceptical about authority.
4. The Distrustful: 20%
Lacked trust in Government and authority. Not very interested in science and worried about certain scientific developments. This segment was on average younger than the general population. A significant number were women.
5. The Indifferent: 20% Had a limited understanding of science and were not concerned about its control. Highest proportion of parents with children under 16, with a small proportion of people educated to degree level or higher.

Based on this audience segmentation study, as much as 40 per cent of the UK public could be categorised as unengaged or disengaged with science. This might of course vary issue to issue, and not preclude them from taking part in some science debates, but they were in general not very interested in science.

In Australia, the Victorian Department of Innovation, Industry, and Regional Development conducted a similar segmentation study, based on attitudes and behaviours in seeking information on science in 2007 and 2010. The report, Community Interest and Engagement with Science and Technology in Victoria, found six key segments [2]. These were:

1. Interested/not active: 23% Interested in science but not active in searching for science information. This was the segment with the oldest average age.
2. Interested/active: 27% The True Believers! Interested in science, active in searching for science information and able to find information they can easily understand. Most work full time, are well educated, early adopters, attend science events and follow science stories in the media.
3. Interested/active/can't find: 16%
Interested in science, active in searching for science information but unable to find it or have difficulty understanding it. They want more information on science, watch science documentaries, and want science explained in simple terms.
4. Neutral / not searching: 8% Many female, do not want to know more about science, have other interests. Neutral towards science and not actively searching for science information.
5. The Indifferent: 20%
Have a limited understanding of science and are not concerned about its control. This segment had the highest proportion of parents with children under 16 and only a small proportion of people educated to degree level or higher. Predominantly female, do not enjoy science in the media, nor care how things worked. Felt technology was out of control, and had very black and white views of morals.
6. Disinterested/searching: 8%
Neutral or disinterested towards science but active in searching for science information. The youngest average age, with many sub-groups and 'fringe dwellers'.

By this analysis, about a third of the population surveyed was unengaged in science. This led the National Enabling Technologies Strategies' Public Awareness and Community Engagement program within the Federal Innovation Department to try and find out more about the specific traits of this group. Subsequently the Department held four 'nano-dialogues' in different cities around Australia: Adelaide, Melbourne, Wollongong and Brisbane, on the topics of water, science citizenship, bionics and new materials [3]. The discussions were all framed by topics that were not primarily about science, even when scientific expert input was available to the groups. The objectives of the nano-dialogues were to explore ways that people not interested or engaged in science and technology might come to talk about it [4]. A market research company recruited eight to 10 people per group, using the segments from the Victorian government's study, without informing participants of the exact topic of the matter to be discussed.

The moderation methodology was one of minimal steering, to allow the groups to chart their own directions. This enabled the participants to lead the discussions more than would happen in a focus group, and allowed them to frame the technologies in terms of their own ways of thinking. The result was that discussions frequently moved towards topics related to the type of world we want to live in.

Key Findings

The key findings from the nanodialogues so far have been that the values, interests and levels of awareness in science and technology issues among the disengaged and unengaged members of the public are quite different from those sections of the public who tend to self-select to attend most information or engagement activities. In particular, they often have had poor experiences with science at school that has turned them off the subject. This suggests that the school years are the most crucial point for science education or communications intervention. Other findings included:

- Typically, interactions with S&T were not immediately visible, recalled nor valued,
- Many used and valued using a range of technologies, although not all were mobile phone and internet literate,
- They tended to seek information on science and technology issues primarily from friends and family, with little reference to experts,
- They weren't generally interested in knowing the science behind how something worked, rather all they needed to know was that it worked and would solve a problem, and
- They responded to science and technology discussions overwhelmingly in terms of application. This was well demonstrated by an excerpt from one of the groups:

Moderator: "Nanotechnology – has anybody heard of that term?"

Participant 1: "Sounds like an iPod."

Participant 2: "If I was sitting on the train reading that I'd just turn the page because I'd presume it was over my head."

Moderator: "How do we not switch you off? Does telling you what it does get your attention better than using that term?"

Participant 2: "Don't use that term and I'll be alright"

Participant 3: "Tell me how I'd use it in my own home."

Likewise people who expressed no interest in science nor technology were willing to engage in discussions about water recycling, climate change and cars, as long as discussions were framed in terms of uses. This demonstrates that for the unengaged segments of the community, science discussions sometimes need to not be about the science itself, but how it is used and why. Non-science science communications.

Other findings from the groups reinforced values-based science communications principles that:

- When information is complex, most people make decisions based on their values and beliefs,
- People seek affirmation of their attitudes (or beliefs) – no matter how fringe – and will reject any information that is counter to their attitudes (or beliefs),
- Public concerns about science and technologies are almost never about the science – and scientific information therefore does little to influence those concerns, and
- People most trust those whose values mirror their own.

Conclusions

While this research is only a start, and more work needs to be undertaken to discover how different science and technology issues are viewed (or not viewed) by unengaged members of the public, it is useful to show that the unengaged can be engaged in science discussions if they are not framed as being about science. Of course different countries will undoubtedly have different segments of values, attitudes and behaviours towards science amongst their populations, but it is necessary to find out exactly what they are to understand how many might be unengaged, and what might best engage them. The findings of this small study indicate that unengaged segments of the population tend to have quite different attitudes, values and sources of trust on science and technology, and therefore quite different communication, education or engagement strategies will be needed to best reach them.

References

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34. Impact of Public Communication of Science and Technology on the Indian Society–Development of An Assessment Framework

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Abstract. There is a wide recognition that communication of science and technology plays a central role in the socioeconomic, cultural, and environmental development of any country. It has been a continuous national endeavor both by the governmental and the non-governmental organizations to infuse scientific temper in the society, thereby building a nation of scientifically aware and scientifically thinking people.

In 1980, science communication was given prominence in India's VIth Five Year Plan and two years later the National Council for Science and Technology Communication (NCSTC) was established with a mission to communicate science and technology, stimulate scientific and technological temper and coordinate and orchestrate such efforts to create excitement concerning advances in science and technology, to enable informed decision-making at the grass root level and to encourage intelligent debate on developmental issues. Social impacts of such activities cover a wide spectrum from behavioral/attitudinal changes of the individual to the alterations in the way people live, work, play, develop skills, relate to each other and organize their communities and institutions to meet their needs and guide their collective actions, as well as changes in their characteristic values, beliefs, norms, traditions and perceptions of quality of life and well being. Although much has been achieved, there is still an urgent need to make science communication activities more effective, both in terms of quality and quantity.

In this context, a study had been undertaken to design an impact assessment framework for the NCSTC-Network to assess the effects of public communication of science and technology impacted on the society from both theoretical and empirical angles. The proposed/suggested framework aims to clearly link and, if possible attribute, impacts in behavioral and attitudinal change on the ways in which the stakeholders organize, operate, work, and collaborate to fulfill their respective or collective goals/needs like knowledge gained/diffused, skills developed, awareness and understanding enhanced, contacts and network formed, confidence and credence developed through such activities.

Keywords: Framework, Impact assessment, NCSTC-Network, S&T communication

Introduction

Science and technology is an integral part of the socio-economic developmental process of a country (Ahmed and Stein, 2004). It seeks to build the understanding, skills and knowledge base of individuals and institutions. The importance of science and technology to modern societies and the role of a technologically educated population in promoting social and economic development has long been recognized (United Nations, 2002, 2002a). Science and technology communication is broadly understood as the system of measures aimed at the dissemination (Libutti and Valente, 2006), appropriation and valuing of science and technology goods (Martinez, 1999; Simon, 2009) which include critical thought, ideas and values (Burns et al., 2003; Treise and Weigold, 2002), history and sociology of scientific knowledge, how science is practiced and the results of scientific research and technological development (Abreu, 2004; Lee et al., 2005; Miller, 2004).

The communication of science and technology plays a central role in the socioeconomic, cultural, and environmental development of any country (Miller et al., 1997; Rogers, 1976). In socioeconomic terms, the communication of science and technology makes it possible to spark new vocations and encourage talent for scientific research, technological development, and intellectual endeavors in general (Miller, 1995, 1998, 2004; Miller and Kimmel, 2001). It fosters creativity and innovation contributing in the production of better trained human resources, expands social opportunities and strengthens the educational system. Culturally and environmentally, the popularization of science enhances the critical sense of the population, by increasing its involvement in decision- making and contributing to democratic stability and sustainable development (Ahmed and Stein, 2004; Powell and Kleinman, 2008).

It has been a continuous national endeavor both by the governmental and the non-governmental organizations, to infuse scientific temper in the society, thereby building a nation of scientifically aware and thinking people (Mazzonetto, 2005). Despite the efforts, many citizens remain ill-informed about scientific advances. For example, an analysis of survey results aimed at determining civic scientific literacy indicates that only slightly over 10 % of the population of 14 industrialized countries has a good understanding both of scientific concepts and methods (Miller, 1996). Various agents are involved in popularizing science, each with different roles and functions. Therefore, popularization of science requires integrated action by knowledge producers, such as scientists, researchers and intellectuals, and knowledge disseminators, such as journalists, publicists, museologists, teachers, audiovisual aid producers, and members of scientific, cultural, and social institutions.

In India, NCSTC-Network has been doing pioneering work in this direction for the last twenty years with the objective of science and technology communication. It endeavors to communicate science and technology, stimulate scientific and technological temper and coordinate and orchestrate such efforts to create excitement concerning advances in science and technology, to enable informed decision-making at the grass roots level and to encourage intelligent debate on developmental issues. National Teacher's Science Congress and National Children's Science Congress are regularly being organized to enlighten both the teachers and children to share critical review of science education and to relate the learning of science to their immediate social and physical environment. Several schools, colleges and Non Governmental Organizations also contribute considerably in this perspective. Apart from these two programmes, NCSTC-Network has also organized several other programmes such as Year of Scientific Awareness-2004, Appreciating Physics in daily life-2005, Understanding Planet Earth Programme-2008-09 and also activities during the first run of the Science Express which was started on October 2007 and ended on May 2008.

Social impacts of such programs include changes that affect individuals, groups, communities and populations as well as the interactions between them. They are alterations in the way people live, work, play, relate to each other and organize their communities and institutions to meet their needs and guide their collective actions, as well as changes in their characteristic values, beliefs, norms, traditions and perceptions of quality of life and well being. In this short span of twenty years, NCSTC-Network has several accolades to its credit. Its activities have different effects on the audience with different impacts. It has developed a network of around 70-80 strong S&T based members to propagate its mission/goals and to help it in planning various activities. However, in spite of all efforts, there still exists a huge gap between the desired and the actual social perceptions of scientific knowledge. Little studies have been carried out to measure and evaluate the civic scientific literacy and impacts of science and technology communication programmes being performed by the NCSTC-Network.

The present study aims at designing an impact assessment framework for the NCSTC-Network from both theoretical and empirical angles taking into account various activities/programs performed by the network members. Although, rigorous analyses can be performed, it will be appropriate to mention that the methodologies/framework adopted/suggested would be 'indicative' in nature.

Methodology and Approaches

Selection of programmes

As a preliminary step in the application of impact assessment study, selection criteria has been applied to shortlist the S&T communication related programmes for which societal impacts are easily visible along with available data. Two major programmes performed and executed by the NCSTC Network viz., National Teacher's Science Congress (NTSC) and National Children's Science Congress (NCSC) have been considered in the present study, though they are conducting several other programmes during this twenty years of time, viz., Year of Scientific Awareness- 2004, Appreciating Physics in Everyday Life- 2006, Understanding Planet Earth Programme-2008 & 09.

Background analysis

Background analysis is the preliminary step to determine whether social effects are likely to occur as a result of the proposed programme. Background analysis has been performed to identify as many as possible of the user groups and communities that may be affected by the action. Various clues to the nature and intensity of possible social impacts obtained from different stakeholders and network members participating in the process have been recorded.

Data collection strategies

Data collection is not only a very challenging job but also labour intensive, time consuming and expensive. A brief description of various kinds of data collection strategies which can successfully be explored to capture the science communication activities performed by the NCSTC Network is presented below:

1. Case studies: Case studies are a structured and detailed investigation of an organization. They are designed to analyze the context and the processes involved in science communication. The questions asked and methods used generally differ from case to case, so they cannot be considered strictly comparable. Because case studies

are in-depth investigations, they can make good use of any combination of different evaluation tools, including direct observations and reviewing existing documents.

- Direct observations: This tool is particularly useful in assessing scientific awareness built. It highlights the potential value of enlisting external experts to observe an organization's activities and facilities, and how they are mobilizing people from scientific capacity building perspective. Internal staff and managers are often so familiar with the organizational environment that they no longer notice good or bad aspects of the organization. An outsider with knowledge of similar organizations might see these immediately. This tool can be particularly effective when combined with self-assessment.
- Review of existing documents: Archives, websites, annual reports, budgets and minutes of meetings are an indispensable source of information and a good starting point for discussion about the impacts of science popularization activities. They also provide a focus for the collection of additional information. If records are well kept and complete, they can provide essential quantitative information about inputs to scientific awareness building, staffing issues, remuneration and working conditions, the utilization of resources, and the overall performance of an organization over time.

2. Interviews: Interviews can be conducted to obtain more detailed information on aspects of the science communication activity. Interviewees can be selected on the basis of their responses to survey questions, an affiliation with important interest groups or expert knowledge. Different types of interview methods can be used to elicit different kinds of information.

- Self-assessment workshops: Self-assessment workshops provide an extremely useful means of gathering and analyzing information from organizational science communication initiatives and interpreting results. They also help to build awareness and commitment to the evaluation and support the validation and enrichment of information, conclusions and recommendations. High-level facilitation skills and the proficient utilization of tools for group analysis, synthesis of findings and reporting of results are essential for the successful implementation of these workshops.
- Key informant interviews: Key informant interviews are generally in-depth, face-to-face discussions with individuals selected on the basis of their affiliation with certain interest groups, or because they are regarded as particularly experienced, insightful or well informed. This tool enables evaluation specialists to capture the views and expectations of stakeholders, such as staff members, clients and end users, concerning awareness-building efforts and changes in scientific rationality and performance over time. These interviews with individuals who are part of the organizational supply chain can also provide important insights into why changes did or did not occur.
- Group interviews: Group interviews lie somewhere on the continuum between key informant interviews and self-assessment workshops. If competently facilitated, group interviews can capture consensus views of relatively homogeneous groups. They are less appropriate with more heterogeneous groups or when certain individuals tend to dominate the conversation.
- Personal histories: It is particularly useful when the evaluation covers a long period and/or documentation is limited. Personal histories can capture the perspective of key players concerning the history of an organization, their own personal and professional development.

3. Surveys: The questionnaire survey is probably the most frequently used tool for collecting information for evaluations. Surveys tend to be time- and resource intensive, however, require specialist skills for the preparation of the survey forms, sampling techniques, administration of the survey, management of databases for quantitative and qualitative information, statistical analysis and research. They may also require translation into a number of local languages, in which case the results then have to be processed in those languages and reconstituted into a single set of results.

Questionnaire surveys are an extremely useful tool in science communication evaluation. They can be used to identify the skills and knowledge gained as a result of training, workshops, conference activities and what skills they have been able to use on the job. Ideally, surveys are conducted:

- before training, workshops, conference to establish baseline capacities
- on completion of training, workshops, conference to assess capacity built
- post training, workshops, conference and return to the work environment to collect information on capacity utilized
- some time after to assess the impact of the training, workshops, conference.

Selection of variables

Selection of variables depends to a large part on the availability and reliability of data. The researcher undertaking the analysis will establish standards and criteria for the analysis after reviewing data and considering the time and effort needed for the analysis. The goal of variable selection is to select social factors, from those in the baseline studies, that can be measured in a quantifiable way, thus ensuring that the analysis and assessment can easily be replicated and increasing the objectivity and defensibility of the analysis. Qualitative data is normally used to supplement and interpret the quantitative one. In some cases, information will be primarily qualitative supported by one or two quantifiable variables. Development of matrices of variables, the baseline case and alternative scenarios is often the simplest way of showing social change and social impacts. The selection of the key sub-variables from each general category should meet the general standards and criteria such as relevance to the analysis; significance; availability; efficiency; sensitivity; accuracy; and validity. However, without adequate baseline data and careful analysis, an impact assessment does not provide the decision-maker with assessments which help understand long term impacts. Availability of historical time series data can provide further objectivity and clarity to impact assessment studies.

Identification of indicators

Identification and selection of indicators is one of the most important steps in the impact assessment process. Care must be taken to ensure that the indicators identified actually reflect the potential social effects. Further, the indicators are issue-driven and reflect issues that arose prior to the impact assessment process. Indicators selected should articulate the dimensions of the social system. The indicators associated with the issues can be utilized as major analytical backgrounds for impact assessment studies.

Design of framework / model

Variables, indicators and tools can be integrated into an analytical framework to develop a viable impact assessment framework covering a wide spectrum of impacts through qualitative and quantitative estimation relating to productivity and efficiency effects on NCSTC Network and broader impact on the societal welfare etc.

Suggested Framework

Impact assessment framework

The impacts of NTSC and NCSC which facilitate a wide platform to exchange views on scientific education and enlighten the teachers and students sometimes seems to be overlooked due to shortcomings in attributing/ observing benefits of the conference, training workshop, plenary session and exhibition being conducted by the NCSTC - Network. For example, the exposure of the teachers of rural area to such national event and interaction with educationists of country give them new ideas to teach the students more effectively. However, attention is rarely paid to elucidating and substantiating the assumed linkages between the above activities and the intended or observed impacts on society.

The proposed framework aims to clearly link and, if possible attribute, impacts in behavioral and attitudinal change on the ways in which the stakeholders organize, operate, work, and collaborate to fulfill their respective or collective goals/needs like knowledge gained/diffused, skills developed, awareness and understanding enhanced, contacts and network formed, confidence and credence developed through such activities.

The framework has three parts:

The analytical framework presents the array of pathways through which generation of scientific awareness by way of investments in different activities of the NTSC and NCSC can result in nurturing a sufficient pool of knowledge intensive human resource. The focus is on the teachers and students. However, the benefits accruing to other individuals (like backward communities in the society) flowing indirectly from these activities can also be identified for estimation.

Applying the framework requires assessing what can be measured, how the data can be analyzed and assigning the responsibilities for measurement and analysis. While the goal is to measure impact flows, this may be too costly or, where the pathways are indirect, too complex, so other evidence of impacts should be identified for collection.

Tools for estimating impacts are the third part of the framework. Fig. 1 summarizes the impact framework.

The analytical framework

The analytical framework set out here focuses on evaluating the impacts attributable to NTSC and NCSC activities. This requires mapping the pathways from the science communication to impacts. These pathways may be direct or indirect, strong or weak, and certain or highly uncertain. The mapping should seek to classify the pathways identified according to these criteria.

Application of the analytical framework is the first step in valuing impacts considered attributable to the conference, training workshop, plenary session and exhibition being conducted by the NCSTC Network. Evaluation of benefits is generally easier when the pathways are direct, strong and certain. However, even when they are indirect and somewhat uncertain, a good case should be possible for SWOT analysis if data is available.

The analytical framework is presented in Fig. 2. It shows an array of potential pathways for a range of NTSC and NCSC activities. The framework aims to identify the changes at each level. Working from bottom to top, these changes are as follows.

1. NTSC and NCSC inputs:
   Expenditure on conference, training workshop, plenary session and exhibition by suppliers and participants,
   including the value of time and in-kind support
2. Capacity built in the individual teacher/student/participant. This may include:
   knowledge gained
   skills developed
   awareness and understanding enhanced
   contacts and network formed
   confidence and credence developed
3. Capacity utilized by the organization from which the participants take part. The change in practice and/or behaviour resulting from the utilization of new experience built could include:
   training of other staff, which in turn leads to:
   i. application of the capacity to work to improve quality, effectiveness and/or efficiency of service delivery,
   policy advice
   ii. utilisation of new technologies
   iii. greater networking, accessing information, improved communications etc.
4. Impact on the clients (teachers/students) arising from capacity utilized. These can be:
   observable changes in low cost innovation techniques employed by teachers, and/or
   changes in the operating environment where teachers educate the students in school or colleges.
   changes in skill and problem solving capacity among the students to meet the needs of the society.
5. Observed benefits and external factors:
   the benefits accruing to teachers, students and other stakeholders (backward communities) as a result of the newly adopted scientific knowledge.

Applying the Framework

This section of the impact assessment framework guides the user through five steps for applying the framework. These steps map the pathways and establish the means by which the validity of the identified changes can be substantiated:

1. utilise the framework to identify the changes occurring as a result of conference, training workshop, plenary session and exhibition (map the pathways)
2. determine the measures and indicators required to verify the identified changes
3. establish the data required for the measures and indicators, verify the availability of these data from appropriate sources and select the most appropriate tools for the collection and analysis of the data
4. determine the extent to which benefits can be attributed to the capacity-building activity
5. assign responsibilities for data collection and evaluation and reporting.

Tools for estimating impacts

The intended impacts to be effected on the society have been explicitly expressed in the NTSC and NCSC programmes itself. Examples of the potential measures and indicators of this change in the scientific awareness, as well as the data required, the data sources and appropriate evaluation tools are outlined in Table 1.

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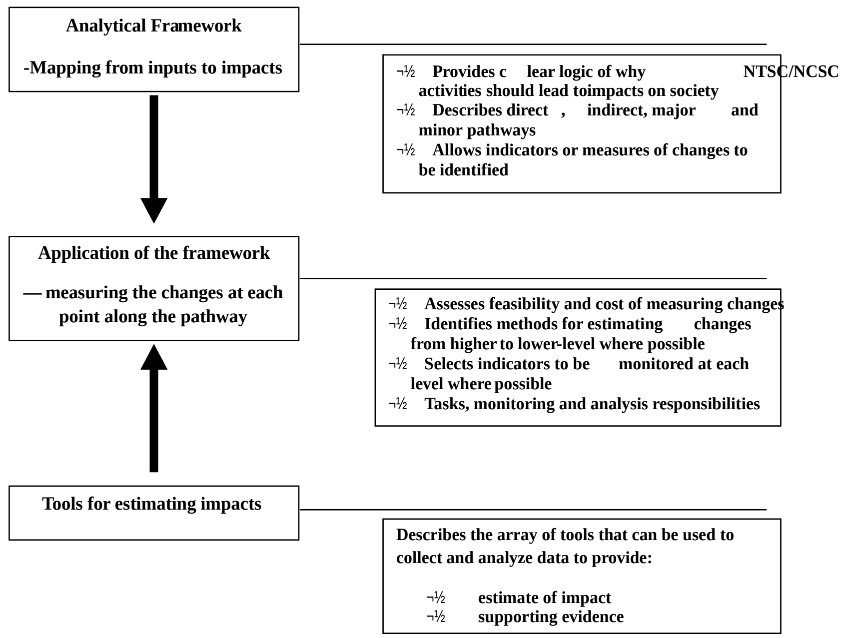

Fig. 1. The Impact Assessment Framework

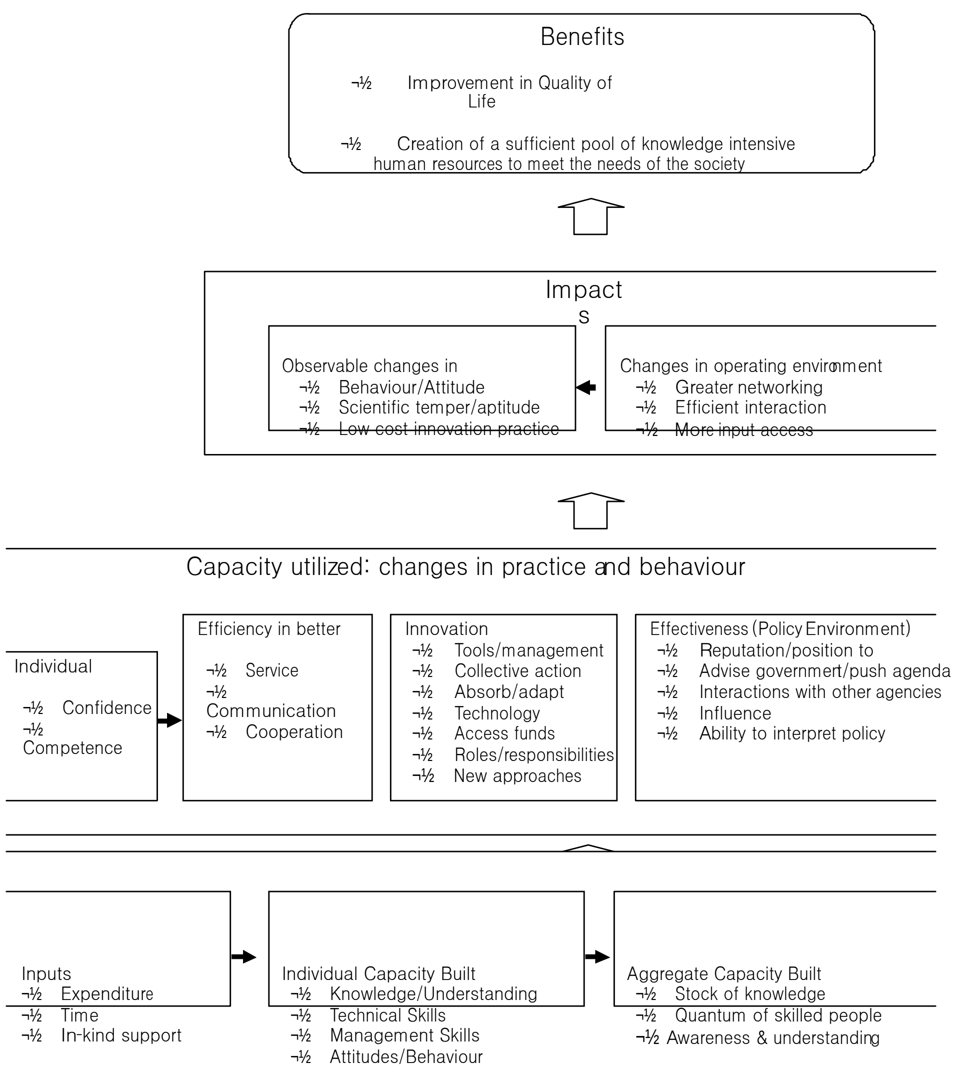

Fig. 2. The Analytical Framework

Table 1. Potential indicators and tools for estimating impacts

Indicator	Data required		Data source
Tool Quantum of scientific temper built	Existing capacity: sum of study years plus years of experience	Records kept by NCSTC review	Document
(knowledge gained/skill developed/ awareness and understanding enhanced/ contacts and network formed/ confidence and credence developed etc.)	Capacity added by conference, equivalence to experience etc.	involved in relevant work in target area(s);	Key stakeholder interview
Quality of conference, training workshop, plenary session and exhibition etc.	Assessment of content of conference, training workshop, plenary session and exhibition	Previous similar estimates Expert opinion	Expert document review
Attendance many participants/how	how many sessions	NCSTC/Conference sessions	Document review
Quality delivery of Conference/Workshops etc.	Participants opinions	Attendance sheets kept by the organizers	Post-training survey
Participants satisfaction Post-training survey	Participants opinions	Participants	
Quality of Reports to stock of knowledge	Reports to stock of knowledge	NCSTC Expert review	

35. Not Just a Coffee: Science Cafés as Low Budget but Potentially High Impact Tools of Science Communication The Case Studies of the Czech Republic and South Tyrol

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Abstract. Science cafés are currently organized in many countries. This low profile, low budget format could significantly contribute to shape the advancement of scientific culture within a society. However, turning a science café into a successful science communication tool is not a trivial exercise. This paper combines the experiences of two different organizers of science café event—the first is private research centre (European Academy of Bozen/Bolzano in Italy) and the second is a non-profit organization (Civic Association Otevirame in Czech Republic). The primary aim of this study is to share best practices in the organization of science cafés in order to help potential organizers in other countries and to compare experiences.

Keywords: Best practice, communication, culture, Czech Republic, events, Italy, participatory discussion, science, science cafés.

Introduction: What is a Science Café?

The science café (or café scientifique) is a very simple and low profile format for the public communication of science. Started by Duncan Dallas in Leeds (UK) in 1998 on the basis of the French "café philosophique", nowadays it is difficult to keep track of all the initiatives worldwide (The Café Scientifique Homepage contains 116 contacts in Europe alone, but not all science cafés are mentioned).

The basic principle of a science café is very simple. A science café is an informal meeting of scientists and the general public. It takes place in a public café, where plain language, an inclusive communication style, good drinks and (sometimes) music combine to create a welcoming and comfortable atmosphere. Each meeting focuses on a specific topic, selected from all scientific disciplines.

There are many variants of the basic science café. Some organizers invite a facilitator who interviews the scientists and moderates the interaction with the audience; others just introduce the speakers, who briefly present their topics on their own (5 to 20 minutes each), followed by a pause and a period of questions and comments from the audience. Some science cafés invite scientists only; others propose an interdisciplinary look at a topic by inviting artists, business men, writers and so forth.

In some venues, speakers are allowed to show Power Point presentations or videos; other organizers exclude all formats except storytelling.

This paper documents how two different organizers with two different backgrounds are approaching the organization of their science cafés, and, by sharing their experience, the authors explore some of the reasons that make the science café an interesting channel of the public communication of science. The two case studies are the science cafés held in Prague, Czech Republic, and in Bolzano, Italy.

The science cafés in Bolzano, South Tyrol, Italy began in 2005, organized by the Scientific Communication Department of a research institute called the European Academy of Bolzano/Bozen (EURAC). Conceived as a public relations strategy, they have grown more and more to become an important tool in the citizens' debate process. Fifty-five events have been organized so far. In 2008, a supplementary edition of the science cafés took place in cooperation with the local Innovation Park (TIS).

Beginning in 2008 in Prague, the Science Café Czech Republic has become a veritable brand, overseeing meetings in five towns of the Czech Republic. Science Café Czech Republic is a voluntary, non-profit project. The idea for the initiative originated with two friends in the autumn of 2007. After founding the unincorporated association Otevirame, the first-ever science café took place in Prague on November 11, 2008, around the topic of Mars exploration. Its motto is "Science as an adventure".

Successful Ingredients

Comfortable venues, smart topics, qualified guests, professional moderation, regular scheduling and a simple but effective advertisement campaign: these are the ingredients for a successful science café. Quantities and proportions might vary from place to place according to available funds and to personal taste.

he following hints are summaries of experience gained in Bolzano and Prague and could be used as “How-To” manual for potential science cafés or serve as a basis of comparison with the experiences of other organizers.

Venue

Finding the right venue for the event is an important step to making science cafés happen. The venue may be the cafeteria of a university or research centre (especially in case where the institution organizes the science café), but never a conference room or similar formal space. Science cafés are all about the right atmosphere. It is essential to find a venue where this atmosphere can be created easily and where the people – both the guests and audiences – are feeling comfortable. The ideal venue is a mid-sized café that is easily accessible by public transportation. Based on the experience of the science cafés in the Czech Republic, it is not difficult to find such a café and make an equitable arrangement with its owner: science cafés bring new customers to the café. Indeed, visitors and guests need some refreshment while chatting, and some might even return to the establishment on their own. It is a golden rule to pay for speakers’ drinks and some snacks might be offered to visitors, but generally visitors pay for their own drinks.

In Prague, the meetings are held in a café (which is also a small theatre) near the downtown core. There’s no admission fee, but in some other cities in Czech Republic, entrance to the Science Café costs 50 CZK (2 EUR), which covers travel costs and refreshments for the speakers (scientists).

The EURAC science café of Bolzano/Bozen takes place on the terrace of the internal cafeteria. The organizers offer snacks to the audience and pay for twenty free drinks per night for guests and collaborators. (The barman even invented special drinks, prepared only during the science cafés, to animate the atmosphere on these evenings.)

Scheduling

It is important that people get used to a consistent schedule of science cafés, so that it becomes a regular monthly or weekly program akin to a regularly-scheduled football match or theatre outing. Dates are established several months in advance so that the audience, organizers, and café owners always know when the next meeting will take place. The Czech Republic Science Café, for instance, is held on a monthly basis, every second Tuesday, beginning at 7 pm, except during summer holidays. Science cafés can take place also weekly in a specific season, which is the case of the EURAC science café (every Wednesday during the summer, beginning at 8:30 pm).

Topics and Guests

There is no golden rule as to which scientist to invite or which topic to choose—any scientific discussion can inspire a science café.

In Bolzano, the starting point of the EURAC Science Café are the current projects of researchers from the research center’s different institutes—from genetic medicine and remote sensing to minority rights. The topics are presented so as to stimulate local public opinion about the connection between research and people’s daily lives. Suggestions of topics from citizens, partners and other science café organizers are always very welcome.

The organizers usually invite at least two guests, in order to encourage discussion. A few combinations are possible: scientists defending conflicting theories, a scientist studying a local situation in contrast with a scientist coming from another context, experts with different backgrounds speaking about the same topic (for example, an historian and a geographer talking about climate change).

In the Czech Republic, the organizers choose their topics and scientists according to their own preference, as well as by recommendation and input from experts and journalists. In the selection of speakers, organizers make sure they are true experts in their field of interest. Popularizing serious and professional scientists and research activities, science cafés generally avoid inviting guests for whom science is a hobby.

Science Café Prague recommends inviting more than one guest, since not only can they complement one another, but they may even save the evening (if one of the two doesn’t turn up).

Both organizers have had fruitful experiences with an interdisciplinary discussion of a topic, inviting, for example, business people, artists, writers, and, most importantly, consumers of science.

Facilitation

Good facilitation of science cafés is key to a successful event. A professional facilitator/host who interviews the scientists and moderates over the discussion (for example, a scientific journalist) can be very useful, particularly when the topics are controversial. However, this might incur an additional cost. A cheaper option would be to elect the host from within the organizing team.

In Prague, each science café starts with a short introduction by the host of the event. He/she introduces the speakers and the agenda for the evening. It is also good to mention the basic rules, the length of the meeting, and how the audience can participate in the discussion. Speakers usually start with a presentation of their topics in short speeches, without the intervention of a facilitator. Organizers discuss with them in advance what they are going to talk about, so that their presentations do not overlap but rather complement one another. After a break, the floor is given to questions and comments from the audience. At the end, it is the host who wraps up the event.

In the EURAC Science Cafés, the role of the facilitator is a much more crucial one. Indeed, speeches by the experts are not planned, in order to break every possible link with a formal lecture or conference. The facilitator interviews the guests, giving the discussion the desired direction, and gradually involving the audience. It is fundamental that the facilitator meets with the invited guests before the science café. He/she does not need to be an expert in the topic they will be talking about. However, he/she must be very sensitive in order to assimilate input from experts and visitors and, bearing in mind the starting topic, keep the focus on the evening's theme. The role of the facilitator is crucial in the case of sensitive topics such as genetically modified organisms or renewable vs. atomic energy.

It is the host who decides when it is appropriate to end the discussion. Depending on the participation level of the audience, discussions may take from one to a few hours.

In Prague, a three-hour debate with a long questions-and-answers session can be a common occurrence. In Bolzano, the public discussion is always wrapped up after one and a half hours. The invited guests are informed well in advance to reserve a good amount of time, however—an avid public can continue the discussion with them in a less formal way after the session officially ends.

Advertising

Bringing together people of all ages, science cafés are often attended by enthusiasts regardless of the topic discussed—they simply love the idea of a science café, since they always learn something new. That's why once you gain a new audience member, you gain also a new promoter. The best promotion is the cheapest: word-of-mouth.

The Internet is a good friend of science café organizers. Up-to-date websites, social networks like Facebook or Twitter and regular newsletters are very effective and low-budget promotional tools (it takes just few clicks to create a Facebook "Fan Page"). Science Café Czech Republic has a profile on Facebook with more than 600 friends, and the community is growing quickly. Newsletter mailing lists are very important as well. EURAC reaches over one thousand subscribers. In particular, in summer of 2010, EURAC Science Café launched a successful campaign: instead of handing out the usual sheets to collect e-mail addresses, the organizers handed out "keep-in-touch" cards, colored business cards that the public filled out and returned. On the first night they collected the same number of contacts they had collected in the whole season the previous year.

Guests are invited to publicize the science cafés on the homepage of their institutions and the PR departments of the respective universities can promote the event as well.

Posters and leaflets are traditional, good communication channels too.

Merchandise can be fun and can be used as a promotional tool. Cups, napkins or sugar-sachets, t-shirts, tray-mats and other items with the science café logo can be used in the café during the meeting and sold to the visitors. The money covers the production costs and the promotion itself.

Cooperation with regional media can be obtained for free. A simple press release and a phone call few days before the event guarantees that broadcasters announce the events on air and/or in newspapers event calendars.

EURAC Science Café cooperates with two radio stations. At the beginning of the summer, the local office of the national broadcaster RAI devotes a whole program (one and a half hours) to announce all upcoming events. Another smaller radio, Radio Tandem, broadcasts a 20-minute-summary after every event. Science Café Prague has a similar agreement with the national radio, which records the whole discussion and then broadcasts it in its "Weekend University" radio program.

Both organizers produce in-house promotional videos, interviews with guests and/or summaries that are uploaded on their homepages and on social networks such as Youtube. The EURAC science café's Youtube channel counts on average 1,400 visits per season.

Pictures taken during the meetings are published online too; people love looking for themselves and friends in albums of public events. Organizers must take care to inform the audience and guests according to local privacy laws.

Technical support

Unless you want to tape a science café in order to submit the recording to a broadcaster or podcast it on the web, you don't need microphones. The audiences are not that big, venues are mid-sized, and everyone can hear each other without amplification.

In Prague, speakers sometimes use Power Point presentations or show videos; in such cases the organizers must provide a projector and a screen (or a simple white wall).

In Bolzano, scientists are encouraged to talk with the audience; they make no presentation but they directly answer the questions of the facilitators. Sometimes a cartoonist interprets the discussion visually, so a surface for his/her drawings is provided as well.

Hands on… the Scientists

"Don't you think your research is controversial from an ethical point of view?", "Would you sell the results of your studies?". These questions were asked of a geneticist during a science café about medical research on neurological illnesses.

Ideally, each science café focuses on one major topic only—selected from the natural or social sciences. Organizers must narrow it down with the guests' specializations and link it to current topics. The title of the science café and a short introduction should make clear to guest speakers and the public what to expect. However, the guests should be quite flexible in their approach. Audiences are often very interested in the personal point of view of the researchers about a topic and in the way scientists do their work.

The goal of the science café is to portray science in a new and informal way. Since not all scientists are aware of this objective, it is useful to remind them they are not going to be giving a university lecture to informed students, but rather partake in an informal discussion with non-experts interested in science. Speaking about his or her own personal experiences and personal opinions makes the career of the scientist more tangible. Scientists are sometime encouraged to bring an object dealing with their research—it could be something from the laboratory, a gadget or an artifact.

Science cafés can train scientists to interact with the public: sometimes they receive stimulating input by non-experts who look at their projects with 'neutral' eyes.

Hands on… the Audience

A science café can definitely be called a success if it is attended by 100 visitors or more. On the other hand, such a large crowd will not be conducive to discussion. Based on the authors' experiences, the most successful science cafés are attended by smaller groups, on average 50 people (a mix of students, professionals, journalists and seniors). That number and composition of attendees enabled true dialogue and interaction between scientists and the public. Even if the guest speakers are given the spotlight as experts, everybody in the café has the same right to speak.

Small and Lively, Ergo Successful

"Great training in participatory discussion", wrote one audience member in his Facebook profile after a EURAC science café about the connection between democracy and the Internet. More than the quantity of the audience, a key criterion to evaluate the success of a science café is the intensity of the debate. Exchanging opinions and asking questions with people on different topics is a good exercise for a local community.

Another advantage worth mentioning is the fact that small events are often seen as less influential on public opinion than larger information campaign or events. That's why science cafés rarely suffer from external political and/or economic pressure. At the same time, they serve as an attention multiplier. Spreading from the bottom up, the vines of scientific culture weave the public debate through friends, social network users, radio audiences, and so on.

In particular, science cafés represent a propitious stage for open discussion about current burning topics.

Science cafés can be used as a tool for civil society: they build awareness of the connections between science and society and of its role in decision-making processes.

The Science Café Czech Republic promotes a wide range of scientific discussion, but applies a strict rule: no religion and no politics. In contrast to this, EURAC Science Café is open to all current event topics, providing a scientific background to the discussion. For example, a café was held about a proposed Italian law on artificial insemination, and a few cafés were devoted the comparisons between the Islamic and Christian religions in different themes (medical care, the role of women, political participation). In these cases, good facilitation is essential.

Let's Talk Money

Science cafés are a cheap solution when compared to other science events such as festivals or exhibitions. A private group with few sponsors (small grants awarded by municipal authorities or private sponsors), such as is the case of Science Café Czech Republic, can produce its science café events through a non-profit organization organized and run mainly by volunteers.

A public relations department of a research institution, such as the European Academy, can reach wide visibility with limited investment.

Science cafés usually adopt an honorarium-free principle. Generally, scientists are pleased to present to their projects to the public, and don't ask for money. By selecting guests locally (for example, the local university, hospital or private research centre), travel expenses are reduced.

The EURAC science café offers a (very) small fee solely to professional facilitators and scientists coming from distant universities.

Promotion via the Internet works very well and is not that expensive; leaflets and other printed material can be done in-house and be very simple. A private sponsor can finance the printing. The venue can be "borrowed" free of charge.

Starting with a basic investment of hundred Euros per evening, including drinks and travel and administrative expenses, costs can rise according to the capacity of the organization. If the organizers manage to find wealthy sponsors, or if the management recognizes in the science cafés a fruitful PR vehicle, the organizers can invest in external experts and attractions such as a DJ or band playing after the official end of the session.

Network

In the Czech Republic as in Italy the number of the science cafés is currently on the rise. In both countries there's a network connecting them all, even if they are very different in nature.

In the Czech Republic the science cafés appeared in 2008 in Prague, and since then the Civic Association Otevirame that launched them has promoted other meetings in different cities under the same umbrella. The non-profit association issued a handbook for new organizers and provides start-up support to new science cafés.

In Italy, the first science cafés started few years before, in the late nineties (the first science cafés started in Florence). Since then the network has been informal: information exchanges via newsletters and a website. In the summer of 2010, the coordination group has been considering whether a separate entity such as an association should be founded.

Conclusion

'One swallow does not a summer make', observed Aristotle in the 4th century BCE. Similarly, a science café cannot be the only player in the field of the public communication of science and technology. Nonetheless, an extensive network of science cafés could significantly contribute to shape the scientific culture of a society from the bottom up, as well as to facilitate the exercise of participatory democracy. This communication format truly promotes the unfiltered exchange between experts and non-experts.

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36. Public Understanding of Renewable Energy PURE

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Abstract. Public understanding of science PUS is a central concept among science communicators. Public understanding of renewable energy PURE is proposed as an important sub-concept of PUS. The aim of our paper is to interest and invite science communication scientists to join a PURE research project. Four separate important questions for a PURE research project can be identified: (A) Is PURE important? (B) Which issues of PURE are the most important ones, according to renewable energy scientists? (C) What understanding of renewable energy has the general public today, worldwide? (D) How to achieve PURE?

Keywords: Public understanding of science, PURE, PUS, Renewable energy, science communication, science centre.

Introduction and Definitions

Public understanding of science is today an established concept. There is even since 1992 a scientific journal with this name. The concept is usually referred to as PUS. Bauer (2009) has given a 3-fold definition of PUS: (1) "Debunking of superstitions, half-knowledge, complete and utter ignorance, misunderstanding and mumbo-jumbo, and virulent memes that give rise to anti-science." (2) PUS is to "improve science literacy, to mobilize favorable attitudes in support of science and new technology, to increase interest in science among young people and other segments of society, and to intensify public's engagement with science in general and for the greater good of society." (3) "PUS considers common sense as an asset" and PUS research should "chart out the public controversies arising from new developments and in different regions of the world" exemplified by "the impact of the climate of opinion on knowledge production."

During the planning of Sweden's first science centre The Futures' Museum, one of the authors (Broman) gave seven reasons for creating a science centre (Broman 1984, slightly revised 2004b): (1) Give an insight that science is understandable. (2) Awaken curiosity. (3) Give people the courage to experiment. (4) Facilitate public understanding of science. (5) Provide preparedness to withstand superstition and pseudoscience. (6)Amuse and entertain. (7) Provide aesthetic experiences. The reasons have been described in some detail in English elsewhere (Broman 2005). Reason (4) is in line with Bauer's definitions (2) and (3), and reason (5) coincides with Bauer's definition (1).

Underlying the statements is the notion that PUS is important, which scientists happily believe, and we of course agree, but it is not as simple as that. There are e.g. so many different sciences (which in turn are divided into many disciplines). A rather popular notion is that "science" is that same as "natural sciences", but that is not the case. Again citing Bauer, science also "includes engineering and medicine, the social sciences and humanities, old and new disciplines with clear boundaries, but also ... fuzzy transdisciplinary techno-sciences." But maybe all different disciplines are not equally important that the public understands?

It is also vital to identify target groups, since some may be more important than other. Loosely defined target groups frequently mentioned are young people (in the world of science centres often restricted to the "7-eleven group" of elementary school children), voting adults, and decision makers. Other interesting group may include teenagers, refugees, religious fundamentalists, senior citizens, people living in villages as well as cities, just to name a few.

It is also important to identify groups of science communicators. As an example, The European Science Communication Network ESCOnet, 2005-8 developed and conducted a series of workshops on science communication training aimed at young post-doc researchers (Miller et al. 2009).

Since renewable energy is our main interest, the authors have decided to investigate a sub-set of PUS, namely public understanding of renewable energy PURE. The remainder of this article attempts to give a starting point of a potential research project on PURE. The main questions are "is PURE important?" and, if the answer is yes, "how could PURE be achieved, and which meansof achieving PURE are potentially useful?"

On the Importance of Public Understanding of Renewable Energy

There are several reasons why public understanding of renewable energy might be important. Four of them are these:

(1) The earth is a lonely planet in a vast space, not as crowded as the impression one gets from science fiction movies. For humans to move from a destroyed earth to another hospitable planet is just impossible.

(2) The earth is a planet alive with a dead sister and a dead brother. Venus is too hot for life due (also) to too much greenhouse gas, while Mars is too cold due (also) to too little greenhouse gas.

(3) Anthropogenic influence on the world's climate, in particular climate warming due to release of greenhouse gasses like carbon dioxide CO2 and methane CH4 is generally agreed upon among (IPCC 2007).

(4) One major source of greenhouse gases is combustion of fossil fuels, which has to be replaced by increased energy efficiency and large-scale worldwide dissemination of appropriate technologies for harnessing renewable sources of energy. A reasonable conclusion is that public understanding of renewable energy is important. An important task of a

research project on PURE would be to identify pros and cons in this respect. There are also several attendant questions: What do professionals - researchers, planetarians, teachers - say? How interested is the public–and different target groups–in renewable energy, and what do they already know? Which disciplines in renewable energy science are more important than others? A very crucial role exists of common people in the success of this objective of large scale harnessing of renewable sources of energy, since as adoption as well as design, developing, manufacturing etc, would require their participation.

How Could Public Understanding of Renewable Energy be Achieved, and which Means Are Potentially Useful?

There are of course several different channels that can be and are used in conveying attitudes towards and knowledge of renewable energy subjects: Newspapers, TV programs, books, interactive exhibits in science centres, lessons in the school. Different media certainly attract different target groups. One of the tasks for the project to find out is of course how science centres with interactive exhibits can be used for the envisaged purpose i.e. PURE. It is even not possible to judge all centres the same - it is of course a great difference between large science centers (like Nehru Science Centre in Bombay, Cité de Science and Technologie in Paris or Exploratorium in San Francisco) and small ones (like Ekohuset in Strömstad and Molekylverkstan in Stenungsund; both Sweden).

As has been shown by several authors, among them Franck Pettersen in a master thesis (Pettersen, 1995), is that a combination of watching a planetarium show and doing experiments related to the show is very useful. (Planetariums used to be devoted basically to astronomy using a classical opto-mechanical star projector. Increasingly, planetariums today concentrate on edutainment shows with astronomic content, using all-dome video technique. Shows related to climate change and its solutions would be easily produced using modern planetarium projectors and would fit nicely under the planetarium dome.) Here are two other voices on interactivity:

Michael Spock, former Director of Boston Children's Museum, borrowed the Chinese philosopher Confucius' proverb as a motto for the museum: I hear and I forget, I see and I remember, I do and I understand (cited in Ott 2001).

William Glasser wrote (1990): We learn 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we both see and hear, 70% of what is discussed with others, 80% of what we experience, and 95% of what we teach.

An important component of achieving PURE is likely to be interactivity and hands-on experience, and useful environments for this are science centres. Some examples of this are shown elsewhere (Broman 2004a) in photographs from the Teknoland outdoor science centre 2000-2001: Yourself a Sundial, Toddlers' Teknoland, Solar Energy Surfaces, The Greenhouse, and The Solar Heated Chess Board.

Popular education of renewable energy through IASEE and ISREE

International Association of Solar Energy Education IASEE started in December 1989. In September 1990, IASEE became the International Solar Energy Society ISES Working Group on education (see e.g. Blum et al. 1994). Also since 1991, IASEE has arranged a series of symposiums, International Symposium on Renewable Energy Education ISREE, held every or every second year, sometimes as part of the biennial ISES Solar World Congress. At each symposium, between 10 and 30 papers were presented. Most papers have dealt with education in schools and at university level, and certainly school children and university students are important target groups, but here we will concentrate ourselves on the general public.

One of the 1991 ISREE papers presented was On the Need for Solar Energy Education (Broman and Ott 1992). In this paper, elementary and secondary school education, vocational training, university courses, educating decision makers, and educating the general public are treated. An excerpt from the paper reads (slightly edited):

Educating the general public

Ordinary people are the ultimate utilizers of energy from the sun and accordingly need basic knowledge in how to make use of this new technology and be motivated to use it. A number of ways to educate large populations are readily available. Some proven examples:

Mass media. This includes newspapers, weekly magazines, radio, and TV. You address professional journalists, and if you manage to teach them some basic facts, they will frequently make o good job in popularizing what they have learned.

Exhibitions. We have built both Science Centre exhibitions (1986 and 1990 on solar measurements for the Futures' Museum in Borlänge, Sweden) and travelling exhibitions (Alternative Energy 1976, Solar Energy Exhibition 1989; Broman and Gustafsson 1991). The educational value of an exhibition is greatly improved if it provides hands-on experiences.

Another kind of exhibition is the trade fair with commercial and institutional exhibitors. Such fairs can range in size from the one hundred sqm or so of exhibitions that accompany SERC's Solar Energy Days to the multi-acre exhibition of the UN Conference on New and Renewable Energy Sources of Energy in Nairobi 1981. Such fairs contain up-to-date technological information for many categories of visitors and should be made available both to professionals and to the general public.

Lectures, etc. General admission popular lectures sometimes attract good-size crowds, especially if arranged as debates or panel discussions, or if a well-known speaker is featured. Lectures can also be video-taped, and can, with appropriate solar powered equipment, be shown just about anywhere (Arafa 1992).

Community college courses. These are excellent in giving interested individuals more-than-basic knowledge. The aim of such courses can even be that every participant builds his own solar collector (see Börjesson et al. 1994).

Another paper at ISREE'91 dealt with renewable energy education and training in an Egyptian village with a programme consisting of public presentations, group discussions, simple solar kits, children competitions, technical training workshops, exhibits with working models, working systems, video-training systems, and a communal library (Arafa 1992). A regional training workshop was held in Libya in December 1990 with the objective of familiarizing women in developing countries with renewable energy development and technology; the workshop was presented at ISREE'92 (Bara and Muntasser 1993).

A community college type of educating people that is popular in Sweden is called study circles. A typical study circle consists of a circle leader - the teacher - and 5-10 participants. Especially during the 1990ies, knowledge about solar heating was spread in many locations in Sweden in this form, where each study group built a solar heating system at one of the participants' house, using a popular build-yourself solar collector kit; this was presented at ISREE'93 (Börjesson et al. 1994). A thorough investigation of this kind of education is a case study done by by Henning (2000).

The importance of public understanding of renewable energy was dealt with at ISREE'02 (Broman 2002). In this paper, a result from SAS (Sjøberg 2000) was cited:

The study Science and Scientists (SAS) asked ten thousand (10 000) 13-year old pupils in 21 countries:

"What do you want to learn about?"

"New sources of energy - sun, wind"

was among the 25% least popular answers, and it was much less popular among girls than among boys.

* Why is it so?
* Should we do something about it?
* If so, how?
* Why is it so?

Pupils - and adults - are interested in scientific and technological subjects

for a number of reasons:

* Economical reasons
* Usefulness
* Interesting, fun

* Relevant

Renewable energy obviously does not meet these requirements! At ISREE'02, the rhetorical question "Should we do something about it?" was answered with a "Yes!", followed by

"If so, how?" and a try to answer:

- Visibility of renewable energy is important
- The school is important
- Media are important
- Exhibitions, Science Centres and Science Parks could be used to meet people of all ages."

Experiences from using science centre exhibits in educating the general public on renewable energy were presented at ISREE'03 (Broman, 2004a).

Renewable energy dissemination at village level

A large proportion of the Earth's population is rural, and their quality of life could be improved at the same time as their impact affection on climate is decreased by introduction of renewable energy utilization at village level: "Low carbon technology for low-purchasing power people." This includes a multitude of technologies and education of users is therefore critically important. A good example is dissemination of family size biogas plants in India - to date 4 million units and the aim to increase the number of plants to 12 million.

Another example: Electricity for light has quickly become affordable by the development of low-cost white high-intensity low-energy light emitting diodes (LED). Mobile phones are spreading rapidly also among rural people in developing countries, and these are effectively charged using the same small not-so-expensive photovoltaic (PV) modules used for powering LED lamps.

When educating rural people, it should be understood that many people live below the poverty line and that illiteracy is common. It is not always easy as the following example may illustrate (Sakr 1984). Egyptian authorities wanted in the early 1980ies to implement solar collectors for water heating in a rural area. The farmers however refused to use them for from their point of view good reasons. In an earlier campaign in the same area, authorities had tried to introduce family planning, and the local people suspected that this new technology was just another attempt to decrease their fertility.

A Public Understanding of Renewable Energy Research Project Proposal

As obvious from the preceding chapters, we have for several years been interested in public understanding of renewable energy. We believe however that presently this concept is more important than ever. An interdisciplinary and international science communication project on PURE is proposed with the hub at Strömstad Academy (www.stromstadakademi.se) in Sweden. It should include both research on the importance of PURE and on the impact of different methods to achieve PURE including determining which methods are best adapted for different target groups.

This means that different target groups have to be approached from renewable energy specialists and energy policy makers to school teachers (Kandpal and Mathur 1982), engineering students (Garg and Kandpal 1996) and different kinds of end-users. A variety of methods, such as questionnaire studies, interviews and focus groups, should be considered.

We have made a start by supervising Science Communication master students and teacher students at Dalarna University during the last decade. A few of them have written their theses on the impact of experimenting with renewable energy at science centres on school pupils in ages 6 to 18. One example is the thesis of Harahsheh (2007), indicating a measurable impact on 15-yr. old pupils on their attitude towards renewable energy.

There is however much more that need to be done. A possible start could be a questionnaire distributed world-wide to a well-defined target group (such as visitors to science centres) aiming at finding out the present level of public understanding renewable energy.

Please contact us if you would like to participate in the PURE project. The authors' email addresses are found at the top of the article.

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37. The Role of Chinese Scientists in Science Communication

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Abstract. By the end of 19th century, the word and concept of science was transplanted into China from Japan. Chinese people accepted the concept of science as the studies of each fields such as physics, chemistry or biology. At the beginning of 20th century, some Chinese students got the funds of boxer indemnity to study in America, especially those who studied in Conwell University became aware of the true concept of Science that Science was only refer to each field of research but also or more important, the system of exploration of the nature with observation, hypotheses, experiment, open to colleagues for study with the data and conditions that the results were made. And more important, science was a methodology of universal study of the nature and society, etc. They organized Science Society of China and started publishing a magazine “Ke Xue” (“Science”) in Chinese in 1915 with the objective that trying to introduce the whole concept of Science to Chinese in China.

After the founding of new China in 1949, all the organizations of scientists were mainstreamed into Chinese Union of Natural Scientists and Chinese Union of Popularization of Natural Sciences. They learned the experiences of science popularization activities in Soviet Union in 1950s when Sino-Soviet was in good relations. Mr. Hua Luo-geng was one of them who communicating basic mathematics as optimization to the industrial workers that could be used in practice. He did not stop popularizing the mathematic methods even during the Cultural Revolution.

In the editorial of People’s Daily in 1994 and the Law of Science Popularization in 2002 the government encouraged the scientists to communicate science to the public to combat the superstition and pseudo-science. Chinese Academy of Sciences the top institution of science researches was encouraged to going out to do science communication.

The development of science and technology is getting fast in recent years in China but more and more controversial issues and events that coursed the public skeptical towards science such as the approval of Genetically Modified Rice planting in large fields and the chemical plants that were being tried to built at the area that thought threatened the citizens lives and the environment. The scientists played different roles in these events. I will talk about the roles they are playing during the discussion and events and the data we got from surveys of Chinese scientists towards science communication.

38. Social Agency, Justice and Transformation in the Quest For a Globally Representative Communication of Science

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Abstract. The communication methods and educational systems that are applied to report scientific findings and technological advances to the public have come under repeated critical scrutiny during the past few years. This communication process, often overlooks deep seated philosophical and epistemological differences between cultures and continents. One prominent area of neglect is the failure to incorporate the specific knowledge(s) of traditional communities into mainstream epistemological discourse. Traditional knowledge has historically been restricted as 'discoveries' by outsider researchers. The traditional epistemic status of traditional communities, as a direct result, remains to be considered as incompatible with the 'scientific' and 'progressive' nature of modern western knowledge. Modern science and technology, therefore, is deemed to operate above (and beyond) the more 'primitive' processes of traditional scientific methods. Modern science is only prepared to acknowledge the 'primitive' methods of traditional knowledge systems in so far as the latter serves as confirmation of the formers' alleged superior cognitive status. It is from this so-called superior perspective that modernity will allow itself to speak of 'traditional agricultural methods', 'traditional water harvesting methods' or even 'traditional craft production methods'.

In this paper I will argue against this artificial barrier in the communication of science. Considering science principles as universal, and acknowledging the historical role that philosophers play in contextualising science knowledge, I will present some options to guide the re-alignment of global science communication towards becoming a more inclusive activity between the industrialised and developing worlds by asking fundamental philosophical questions about social justice, agency and the possibility of change. My focus will be on Africa and India. I will mention, in specific, the work of western philosophers such as Jürgen Habermas (1981. 1987, 1994) and Richard Rorty (1980) and African Philosophers such as Paulin Hountondji (1997, 2002) and Kwasi Wiredu (1975, 2000). Their opinions will be juxtaposed against ideas that developed in India as explored by Amarthya Sen (2000).

Keywords: western science, traditional science, epistemology and philosophy.

Introduction

In the wake of a near absence in communicating science to the public in Africa, the discipline of African philosophy took as task the topic of science communication to explore the philosophical relation with science in general and with traditional societies in specific. The development of African philosophy, as a result, is closely associated with the advancement of science and technology. This relationship is not unique. It is similar to the development of European philosophy when philosophy-as-epistemology affiliated strongly with the Enlightenment 'idea of progress'.

During the European Enlightenment science became the 'subject' and scientific method was recognised as the measure for progress. This centrality of philosophy-as-epistemology in the 'project of modernity' and its inability to overcome the reliance on a subject-centred epistemological paradigm, is intensely debated by western philosophers such as Jürgen Habermas (1981; 1987; 1994). Habermas initially strived to reconstruct the genealogy of the modern natural and human sciences by inquiring about the details of their social, historical and epistemological conditions of emergence. He later adopted a perspective based on a theory of 'communicative action' derived from speech- act philosophy, socio-linguistics and ideas about conversational implicature (Honderich, 1995:330). Central to the work of Habermas is, however, the effort to combine specialist philosophical interests with an active commitment to promoting informed discussion on issues of urgent public concern (Honderich, 1995:330). Habermas (1981), in this regard, is a promoter of effective science communication.

The modern-day 'lack of independence' of philosophy (from science progress) has also been dramatically challenged by western philosophers such as Richard Rorty (1980. 1982). Central to Rorty's (1980) challenge is the deconstruction of the ontological assumption of (western) man as the privileged seat and centre of human rationality.

The notion that epistemology can exist as a discipline capable of justifying and validating scientific knowledge claims, is rejected by Rorty (1980). It follows that philosophy is incapable of providing a neutral universal framework that can be assumed (adopted) to precede, justify and validate the foundational scientific form of knowledge. A significant consequence of Rorty's rejection of this epistemological foundationalism is his rejection of a correspondence theory of truth, deemed capable of describing reality 'as it is'. In the place of an objectivist approach to reality as a project of epistemology in the service of science, Rorty (1980:315) encourages his reader to accept the possibility of an epistemological vacuum that naturally follows the demise of the modern epistemological tradition.

Rorty's (1980) arguments against epistemological foundationalism are important in so far as it encourages a re-conceptualization of modernity's central universalistic claims with regard to truth, objectivity and rationality. For as long as nature (the universe) is assumed to be absolutely (ontologically) of humankind, the scientific enterprise will likewise be conceptualized as a discipline that transcends the more parochial interests and passions of the non-scientific thinker.

The importance of this argument for us is Rorty's (1991:166) promotion of a ruthless scepticism about philosophy's self-definition and epistemological 'task' in the defining of science. He criticizes the limitations of philosophy-as-epistemology to recognise appropriate scientific (including traditional) knowledge since science in its current form provides humanity with a basic 'ticking list' of observations which too often lacks deeper probing and rules out further reflection. Sandra Harding (1997:49) maintains that 'modern science' re-inscribes the dichotomy between the dynamic, progressive sciences of the west and the static unchanging traditional knowledge of other cultures. According to Harding (1997) this condition generates the benefits of modern science to be disproportionably distributed to western elites and she claims that: "… whether sciences intended to improve the military, agriculture, manufacturing, health or even the environment, the expanded opportunities that science makes possible have been distributed predominantly to already privileged people of European descent, at the cost to the already poorest, racial and ethnic minorities, women and Third World peoples" (Harding, 1997:55).

According to Rorty (1980), philosophy should abandon efforts to consider reality through some a priori conceptual framework (which we ourselves have put into existence). In addition, philosophy should abandon efforts to claim a universal context for the validation claim of scientific knowledge. Such a post-epistemological approach will render the need for a transcendental foundational discipline obsolete. The real work of science must be done by the scientists, and the philosopher must resist the temptation "… to jack up [the achievements of science] a few levels of abstraction, invent a metaphysical or epistemological or semantic vocabulary into which to translate it, and announce that he has grounded it" (Rorty, 1991:168).

In the place of the modern epistemological legacy of foundationalism, Rorty (1980:315) proposes a hermeneutic approach to rationality and truth in the objective world. According to Honderich (1995:353), hermeneutics refer to "… the inherent circularity of all understanding, or the fact that comprehension can only come about through a tacit foreknowledge that alerts us to salient features of the text which would otherwise escape notice". Bernstein (1983:38) points out that, according to the interpretation of texts, the earlier traditions of hermeneutics distinguished three elements:"… subtilitas intelligendi (understanding), subtilitas explicandi (interpretation) and subtilitas applicandi

(application)". Heidegger (1977) and Gadamer (1975) extended the application of hermeneutics, initially focussed on the interpretation of text, to the interpretation of technology. Gadamer (1975), for example, proposes that the three features of hermeneutics–understanding, interpretation and application–do not happen successively and functions collaboratively. He focuses on the relation between 'practical knowledge' and 'theoretical/technical knowledge' and considers hermeneutics to be the heir of practical philosophy which, in turn, bring concepts such as 'scientific method'

(in the sciences) and historico-critical method (in the human sciences) into question (Gadamer, 1975:342).

According to Rorty, hermeneutics relieves us of the need to justify scientific knowledge claims from a universal perspective. He argues furthermore that the hermeneutic principle of justification of our social principles is sufficient ground for our acceptance of the notion of truth in a pragmatic sense. For Rorty the hermeneutic approach therefore cynically presents "… an expression of hope that the cultural space left by the demise of epistemology will not be filled" (Rorty, 1980:315).

Rorty's (1980) critique of the modern epistemological condition and his philosophical announcement of a post-modern ethos characterized by contingency and pluralism, (in short, an ethos epistemologically devoid of all claims and pretensions to universalism) opens up the possibility and the need to explore other non-western forms of knowledge and rationality. By accepting the ethno-cultural horizons governing one's place in history as the point of departure, Rorty (1980) therefore encourages a more conversational approach to the question of knowledge "… with the notion of truth being associated with the best idea we currently have to explain what is going on" (Rorty
1980:320).

African philosophy in service of science

With the European enlightenment promoting scientific innovations, the 'idea of progress', it was argued, became the measure of modernism in the west. On the other hand, 'colonialism' became the African measure and indicator of scientific progress. It can be argued that colonialisation in Africa marginalised traditional scientific knowledge and traditional practices as rapidly as modern industrial and economic development expanded in the west. Underpinning the idea that all men are the same, the awareness grew that cultures differ and live in different geographical worlds requiring different social strategies for survival. For western science, in the quest to study man, 'race' soon became the marker for different social practices that constitute different cultures. Race therefore became a science 'subject' and racial differences became a cultural 'marker'. The paradoxical result of celebrating differences, respect for pluralism and acknowledgment of identity politics – which became the feature of a liberal-modern democratic outlook – made science a political issue since the science of human differences could only be read in a racial fashion (Malik, 2008). This can be referred to as the 'guilt of science'.

Opinions about the intensity of this marginalisation process vary. Kwasi Wiredu (2000:175), for example, does not consider modernism to be "… bad in and of itself, but [consists of] ill-conceived programs of implementing modernization [that] have been harmful to African societies". Wiredu (1975:320), in addition, implores us to distinguish, in the African context, between traditional – that is pre-scientific spiritualistic thought – and modern scientific theory.

If we consider that epistemology functions in the total context of the human 'right to life' in traditional societies, we need to recognise the universality of these actions. Wiredu (1975), in a sense, blames the west for looking at traditional African epistemology in a highly selectively manner, thereby overlooking the very specific, non-scientific characteristics that typify African traditional thought in general. The west tends to define this specific non-scientific characteristic as a way of thought to be peculiarly African, instead of looking at it in a broader context and acknowledging its striking similarities to western epistemology.

Kwame Gyekye (1997) is less critical about the west's duplicity in the even distribution of modern science and advocates acceptance of western modernity by Africa. According to Gyekye (1997:30), 'modernity' is to be considered an ideal measure of progress. 'Traditional' should be seen as something that should aspire to this ideal of progress by embracing the theoretical development of science that requires sustained scientific probing since "… the impulse for sustained scientific or intellectual probing does not appear to have been nurtured and promoted by our traditional cultures". The African philosopher Kwame Appiah (1992), in contribution to this debate, initiated intense and widespread discussions in Africa on the relationship between race and culture and the differences between indigenous and global knowledge systems. He became overtly concerned with efforts to define the course and causes of development in relation to the growth of science.

Emmanuel Eze (1997:12), who persuasively postulated that the philosophical notion of 'reason' was popularised at the beginning of modern (western) philosophy by Descartes, furthers the argument around indigenous and global knowledge systems by claiming that "… the nature of human rationality seems to require that the best way to define reason philosophically is by demonstration. The demonstration will require amassing empirical or scientific evidence for the rational, and reflecting on this concept of evidentiality". Eze (1997) considers duplicity to be at the heart of modernity whereby modernity, in its subscription to ideals of humanity and democracy, condones the colonial subjugation and marginalization of non-western people by indicating the perceived difference between the rhetoric of the west and the 'lived reality' in Africa.

Based on the contributions by African philosophers, the relationship between philosophy and the sciences is quite pronounced in Africa. Paulin Hountondji (1976:99) in this regard proposes the hypothesis that "… the first precondition for a history of philosophy, the first precondition for philosophy as history, is therefore the existence of a scientific practice, the existence of science as organised material practice reflected in discourse. But one must go back even further: the chief requirement of science itself is writing. It is difficult to imagine a scientific civilisation that is not a civilization based on writing, difficult to imagine a scientific tradition in society in which knowledge can be transmitted orally. Therefore African civilizations could not give birth to any science, in the strictest sense of the word, until they had undergone the profound transformation through which we see them going today, that transformation which is gradually changing them, from within, into literate civilizations".

Ivan Karp (2000:4) appropriately observes that it is clear that African philosophers are divided into two camps; those who believe that technical and academic philosophy provides the tools for a much needed critique and revision of traditional African thought and those who argue that the critical skills and attitudes of western philosophers can also be found in African cultures. However, both these positions have roots in academic and social movements originating from the west. What is lacking is the centralisation of this debate within a non-western context.

Moving Towards Individual Agency, Abstract Theory and Openness–Examples From India

African philosophers realised that they are not alone in feeling marginalized from mainstream science and from being considered within the proviso of being 'underdeveloped' and 'unscientific'. Parallel problems are identified by, for example, the Subaltern group in India whose members argue that the specificity of the subaltern voice

(by implication their epistemological contribution) has been systematically erased by both colonial and nationalist historians. The term 'subaltern' is used to group together the section of society who faces oppression (Morton, 2003). The Italian Marxist, Antonio Gramsci (1881–1937), used 'subaltern' to refer to a person or group of inferior rank or status caused by race, class, gender, sexual orientation, ethnicity or religion. He considered subaltern groups to be, by definition, subjected to the authority of ruling groups even when they rose up in rebellion. His definition of the subaltern was adopted by Gayatri Spivak (1998; 1988) and others because it easily provides a key theoretical resource for understanding the condition of the poor, the lower class and peasantry in India. The parallels drawn by Gramsci between the division of labour in Mussolini's Italy and the colonial division of labour in India, made this possible.

In both India and Africa there is a drive for recognition and respect for the complexities of the motives and cultures of these subaltern agents. This includes, as Karp (2000:3) suggests, respect for "… the complicit role of the intellectual in the power politics and crises of the postcolonial state; the role of criticism in the politics of knowledge; and the conflicts among cosmopolitan, nationalist and indigenous forms of knowledge. Intellectual historians and sociologists of knowledge will have to work out the reasons why parallel critiques have developed in such different disciplinary locations and discursive spaces in Africa and India, and they will also have to work out the differences as well as similarities in the ways in which postcolonial criticism emerges as a formation in two such different geographical and cultural locations".

In India, Amartya Sen (2000) aptly considered these issues mentioned above and, in addition, emphasised the role women can play in bringing about social change through agency and as free agents of change. Sen (2000) discussed in some detail the approach to gender differentiation from studies conducted by Jean Drèze and Mamta Murthi in India in 1999. When considering the high rate of female and child mortality in male dominant societies, causal relations to development were probed in variables, positioning low survival prospects against areas of possible agency: female literacy rates, female labour force participation, incidence of poverty, levels of income, extent of urbanisation, availability of medical facilities and the proportion of socially underprivileged groups (caste) (Sen, 2000).

Two aspects regarding the promotion of literacy in India became clear in the surveys conducted by Drèze and Murthi (1999). In the first place gainful employment produced ambiguous outcomes: responsibilities for household work became an added burden. In the second place, becoming more literate statistically showed a significant reduction of under-five mortality. Finally "… the impact of greater empowerment and agency role of women is not reduced in effectiveness by problems arising from inflexible male participation in child care and household work' (Sen, 2000:197).

Dual Worlds, Multiple Problems–Solutions Through Agency

By looking at hermeneutics, as proposed by Rorty (1980), we are provided with an option to experience some measure of relief from a need to justify scientific knowledge claims from a universal perspective. When we apply the Rortian hermeneutic principle as aid in the justification of our social principles, we might find sufficient ground for change. What these changes should aim to be, however, is difficult to establish. If we liberate the debate from the social movement of post-colonialism we create a 'freezone' where new perspectives on developmental issues can become intertwined with debates on 'scientific validity' and 'scientific literacy' – both prominent issues in science communication debates and the research focussed on by the Public Understanding of Science (PUS). This, however, is no easy task and comes with its own particular and spectacular problems. Aijaz Ahmad (1992:315), for instance, persuasively speculates about a world devoid of differentiated structures and the disappearance of the so-called 'three worlds'. In the problematic issue of merging the world economies, he mentions the subordinated partnership of developing countries with imperial capital as a debilitating factor. He proposes that "… most of the Asian zones simply cannot ever hope to develop stable societies, and the devastating combination of the most modern technology and backward capitalist development is likely to inflict upon these societies, on lands and peoples alike, kinds of degrees of destruction unimaginable even during the colonial period".

The most appropriate option I can think of is to turn–yet again–to the philosophers for redemption. How will they advise science communicators to effectively promote science communication against such a diverse and complex background? Three scenarios are possible:

1. The redemption of traditional knowledge systems (IKS). It is now acknowledged that some aspects of African

thought are collective and unchanging. To emancipate IKS both Wiredu (1980) and Hountondji (1983) valorise the individual as the agent of change through social and cultural criticism. Both use the colonial and postcolonial as spatial and temporal realities and both require the application of individual agency, abstract theory and openness. More specifically, Wiredu (1980) proposes analytical practice in the quest to solve failed past methods and solutions. Hountondji (1983) proposes the Althusserian neo-Marxist notions with its specifying evolving relationships among power, ideology and a constantly changing social world (Karp, 2000:8).

2. Emancipatory social justice through agency. Agency refers to a person being the 'subject of action', who posses the capacity to choose between options and then, ultimately, to be able to do what one chooses. Agency is treated as a causal power (Honderich, 1995:18). In patriarchal societies such as Africa and India, social justice involves more than 'being free to choose'. Social justice means active participation in education. In this regard Marion Young (1990:173) states that: "… a goal of social justice, I will assume, is social equality. Equality refers not primarily to the distribution of social goods, though distributions are certainly entailed by social equality. It refers primarily to the full participation and inclusion of everyone in society's major institutions, and the socially supported substantive opportunity for all to develop and exercise their capacities and realise their choices". Chandra Mohanty (2003:205) adds to this by stating: "Pedagogy needs to be revolutionary to combat business as usual in educational institutions … revolutionary pedagogy needs to lead to a consciousness of injustice".

3. Critically analyse aspects of modernity and tradition in order to promote individual and social agency in the developing worlds. Challenging the concept of western modernism is inevitably linked with the embracement of western capitalism and western scientific rationality. Africa embraced western capitalism but scientific rationality became an ambivalent site of dispute through the polarisation of tradition and modernity. One of the prominent philosophers who challenge Africa to become independent (and literate) in order to participate in the global science debate is Hountondji (2002) who critically recalls comments on the history of integration and subordination of African traditional knowledge to the world system of knowledge. Hountondji, (2002: 501) identifies a number of what he calls 'scientific extroversions' (Africa being forced to integrate into the world market of concepts) which indicates that "… a need to secure an audience or readership, a legitimate need, often leads Southern scholars to a type of mental extroversion. They are pre-orientated in choosing their research topics and methods by the expectations of their potential public which then causes them to lock themselves up into an empirical description of the most peculiar features of their societies, without any consistent effort to interpret, elaborate on, or theorize about these features. In so doing, they implicitly agree to act as informants, though learned informants, for western science and scientists" (Hountondji, 2002: 503).

Conclusion

The list of actions that are required towards achieving social justice in the developing worlds is much more comprehensive and much more complex than the few points I was able to highlight during this presentation. I also hope to further the debate on the complex issues related to the main objective of this conference from a developing world context. As indicated by the organisers of this conference, the economic and social wellbeing of society promotes participatory democracy and implies the ability to respond to technical issues and problems that pervade our daily lives. This, by implication, requires a serious deliberation about the status and relation between modernity and tradition. The perceived gap between modernity and tradition, in facilitation of a better science communication, can only be addressed by a thorough understanding of social justice, the promotion of agency on all levels and collectively amongst all members of society, creating a deliberate possibility of change.

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39. Analysis of Doctoral Research in Science Communication

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Abstract. In this paper we will present a review of over 57 PhD theses on science communication, from 2000-2010, coming from all over the world. From this analysis we reflect on the development of science communication as a scientific domain. The review shows that media relations with science and the means of science communication are the most researched topics. More fundamental theoretical studies or reflections on science communication are much less to be found among PhD-theses. In this paper we discuss this 'rhetorical opportunity' for reflective science communication and we discuss how PhD research might contribute to deeper theoretical development of science communication.

Keywords: Theoretical development, PhD research review, Rhetorical opportunity, Reflective discipline,
Science communication graduate school

Introduction

PhD research is normally recognized as the cutting edge research in a domain. So an overview of theses in a domain might say something about the state of the art in a field from a theoretical perspective. This perspective is important to know since a core of a field describes its rhetorical opportunity (Seydel, 2007): what are the intellectual sources? What is the academic tradition in which the research is carried out? What has science communication to tell based on these sources and traditions to socio-cultural problems.

This question does not stand alone. In the September 2010 issue of the Journal of Science Communication established researchers in the field were asked to reflect on the status of science communication from the point of view of a discipline and a field of study. Pitrelli (2010) asked: What topics should science communication focus on and why? What is the real degree of autonomy from other disciplines? Bell(2010) admitted: if I'm honest, I'm not entirely convinced science communication really exists. But other authors pleaded for further theoretical development (Trench and Bucchi, 2010). They stated that the following conditions should be recognized to be a discipline: (1) a bounded field of study; (2) shared interests, terms and concepts; (3) significant presence in teaching and research in the higher education sector; (4) international research; (5) specialist scholarly publishing; (6) organized communities or networks of scholars; (7) a body of theoretical work that underpins empirical study. In their contribution to this special issue they concentrated on the first and the last point. They stated that science communication is a defined field of study and has grown over the last 20-30 years in the intersections between disciplines such as science education, social studies of science, mass communication and museology. It developed, as Trench and Bucchi describe, as a field of formal study only after it was a named practice with associated training and education programs. So science communication is a field based on various disciplines strongly attached to a practice. From our current analysis of a decade of science communication theses we may obtain insights which are helpful to the other issues raised by Trench and Bucchi as well.

Gascoigne et al (2010), also in this special issue, defined science communication as a field of study based on: 1) the presence of a community; 2) a history of inquiry; 3) a mode of inquiry; 4) the existence of a communications network. They concluded that the technical requirements for being able to claim that a field of research has achieved the status of a discipline, is not clear. Here too this theses review may fill some of the gap Gascoigne et al encounter?

The final contributor to the Journal of Science Communication discussion, Hornig Priest (2010), wonders what it entails to be an academic discipline. She writes that a academic discipline involves attempts to understand, influence, improve and critique the processes of science communication, including attempts to grasp their broader social, political and philosophical significance and dynamics, alongside their immediate impact on individuals and groups. Again, in the case of this paper it might be possible to obtain some of the answers to what Hornig Priest asks, e.g. do the theses critique the existing processes of science communication?

Moreover, Hornig Priest asks herself if there is a need to become a discipline. Some of the interdisciplinary disciplines still stay a subdiscipline. This might be the case for science communication as well. However, she believes that the unique interwoven contributions of subdisciplines are at the core of what gives science communication the potential to continue its emergence as a true interdisciplinary subdiscipline and not just a set of activities or practices or a list of interesting subjects.

From the sub-disciplines as Mulder et al (2009) state, science communication can be considered as an emergent domain, with its own specific multi-disciplinary dynamics. This is, as we will show in this paper, stated by the overall view obtained from a decade of science communication theses. And, as Hornig Priest says, in line with Trench and Bucchi, this is very important, since otherwise the science communication domain would risk being defined merely as the 'outreach' departments of the institutions that produce new knowledge. The latter is indeed happening with the vast European Union projects in which the science communication part is mostly 'reduced' to events and some kind of evaluation. Science communication should be part / integrated in the research process itself and should be researched as such (Van Der Sanden and Osseweijer, in press). PhD research should be the very cutting edge of developments in science communication. Is it possible to fill in or support all the above from a decade of theses? Is there an emergent field of science communication to be discovered? We also asked ourselves how science communication PhD research could be enhanced from an international perspective.

Collection of Data

We collected information on 57 theses world-wide and categorized these theses according to the criteria, major research theme, research aim, research question, research subject, theories / theoretical framework used, mentioned practical implication and kind of research. All respondents sent an abstract and 70% of them also sent a summary. In most cases we received full information in English but some of the theses are in other languages and we had only English translations of the abstracts. However, we believe that this collection of thesis information does give an adequate representation of the issues stated above. Of course, we keep in mind that reviewing the theses will generate a new set of criteria.

Results

In outline numbers we can describe our sample as follows:

Total is: 57

Countries: Ireland, UK, Australia and USA (34); Italy, Netherlands, Austria, Germany, Belgium and Spain (17); Korea, Brasil, Colombia and Japan (6).

Subject: science (19); medicine (15); environment (6); genetics (6) humanities (5); social studies of science like (6);

Research theme: media and journalism (14); means of communication (10); engagement and dialogue (7); scientists' role and image (7); roles of stakeholders (6); evaluation (1); various (12).

Methodology: media-analysis, surveys, interviews and case studies are by far the most popular. Research aims. It is not possible to identify unifying research aims. For example, in the media and journalism theses the stated research aims include:

- analysis of newspaper content and observations and in-depth interviews with Ontario journalists from a variety of print and broadcast media outlets, in rural suburban and urban areas;
- investigates the extent to which a particular group of the public (18-25 years), Northern Ireland, interact with science and the media and what effects it has on their actions, knowledge and understanding of science;
- examines how four contemporary British scientists and popular science writers are portrayed as mass media celebrities;
- examination of representation of science education in UK newspapers and focuses on the role of the expert sources in a controversy about the teaching of creationism alongside the theory of evolution in the science class rooms;
- examines factors shaping journalistic coverage of risk debate involving new technologies;
- explores the role of the press in the process of consolidating the genetic approach to human biology and disease in the Spanish context;

- analyze the relationship between obesity and poverty in Brazilian daily newspapers.

Theories used

Too many to mention here, but these include: health belief model; elaboration likelihood model; self categorization theory; Pierce's semiotic logic; self-transcendence and self-enhancement; framing; theory of planned bevaviour; Philipsen's speech codes theory.

Contribution to domain or practical field

These include:

- the evidence points to of the importance of understanding expertise not only in individual but also in collective terms. Overall, the thesis demonstrates a more complex conceptualization of expertise;
- the thesis argues that universities therefore need to take the responsibility for this in the same way as they are responsible for academic training and research;
- the results have implications for the way in which research institutes incorporate their accountability responsibilities into the organisation's culture;
- the study shows the stability of the normative structure of science.

Conclusion

From the results above we may conclude that: (1) the Anglo-Saxon world is most active in research in this field; (2) hard sciences like medicine and natural science are the most researched subjects of science; (3) media and science journalism are well researched; (4) that there is no identifiable common core of knowledge within those themes or research; (5) there is no identifiable common aim in contributing to the domain or the practical field. It is also difficult to see evidence of the development of: (1) a recognizable theoretical framework; (2) a network or community of researchers; (3) a shared mode of inquiry, interests and concepts and practices.

So from the theses it is only possible to draw some conclusions on the emergent or meta level. We can see, as Trench and Bucchi (2010) describe, a field of formal study in which PhD theses critique the processes of science communication based on various disciplines such as psychology, communication studies, social studies of science. We can also see that all the domains Mulder et al (2008) mention are incorporated in this collection of PhD theses. But none of the theses we have information on critiques the supporting disciplines themselves and there are no theses found so far outside of these discipline boundaries that reflect on science communication. This means that science communication research is broadly in line with where it all started: science and its (needed) societal impact.

Discussion

Is there a clear rhetorical opportunity within these meta boundaries? Science communication makes science tangible by reflection, analysis and synthesis. It is made - tangible through its distinct parts becoming visible in the media and in science communication strategies. The possibilities and impossibilities of science in its societal function become visible through communication.

As it is stated by some of the theses reviewed, when a researcher has a clearer vision of science and its societal impact by means of science communication, the practice of actually doing research is understood much better. Science communication is much more 'science' than 'communication'. However, once you know what to communicate by using communication theories, you know how to communicate. But this communication process itself again is more about science and its impact on its target audiences. With regard to the question of science communication as a discipline the outline of the reviewed theses and the reflection on it might show that we need to think in a reversed mode and conclude that we are a sub-discipline of social studies of science making use of the theories and methodologies of communication to reflect on science and its social importance and interaction. We understand the social studies of science from a communication perspective. Science communication needs to critically engage with communication theories if it is to be recognised as a communication discipline.

This requires much deeper investigation, including analysis of how this PhD research contributes to the theoretical development of the research groups from which it comes. This is a topic that might be part of the agenda for an international gathering of PhD researchers in an international PCST-Graduate School (virtual or physical, or both) that would promote profound thinking on science communication, its starting points and practical implications on the practice of science.

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40. A Study on Science Popularization Work in Community from View of "Last Mile"–Take a Case of Science Popularized Community in Beijing

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Abstract. Based on the investigations and interviews among totally of 123 science popularized communities in Beijing from 2007 to 2010, this paper mainly discusses science popularization work in community from the view of "last mile". According to the general communication model of mass media, there are four basic elements during a communication procedure: information sender, information, communication channel, and information receiver. The paper first talks about the present situation of four aspects of science popularization work in community. Then, the paper analyses the problems existing in the popularization work in community concerning the four aspects. On the basis of some theoretical analysis such as pluralism of subjects and two-way communications in the science popularization, the paper last gives some concrete suggestions for the future development of science popularization work in community.

Keywords: Science popularization; Community; Last mile

Background

Since 2007, I have attended the evaluation of totally 123 science popularized communities in Beijing annually, and I have investigated and interviewed half of these communities on-the-spot. Based on these investigations and interviews, this paper mainly discusses science popularization work in community from the view of "last mile" ---- which means to change the traditional view of up down to the view of bottom up concerning science popularization work.

According to the general communication model of mass media, there are four basic elements during a communication procedure: information sender, information (content), communication channel, and information receiver as following:

information sender → information → communication channel → information receiver

model (1)

As science popularization work in community is concerned, the four basic elements and questions we would like to analyze are as following: subject of science popularization–who sends the information, information of science popularization–what is the content, communication channel of science popularization–by which channels the information is sent, and object of science popularization–to whom the information goes.

Situation of science popularization work in community

In this part, we will talk about the present situation of four aspects of science popularization work in Beijing communities:

Subject of science popularization, usually there is no professionals for the science popularization work in the community, few of the people who are responsible for this work have the relative higher education background or academic training opportunities. As a result, most of the people who are responsible for the science popularization work in the community have little recognition about science popularization, and there is no need to mention the new trends and new methods being used by them.

Content of science popularization, the change rates of contents in the most communities are from once a season to once a half year or a whole year, some communities even have never changed the contents which are eternal as they said! Usually the communities can get some popularizing materials from local bureaus of government especially when there are public hot issues such as SARS in 2003, Olympic Games and earthquake in 2008, in their routine times there are no regular content support of science popularization from government. Some communities can get information of science popularization from books or internet, but even they can surf on internet, many of the workers still can not judge which information are right facing so huge and various opinions on internet.

Communication channel of science popularization, with more and more money from government invested into the grass-root units many communities have built up “digital harbor”(with dozens of computers for residents surfing on internet), LED (Light Emitting Diode) panel to show the content electrically, and DIY(Do It Yourself) Corner with various instruments for science popularization activities, etc. However, with the government paying more attention to the advanced methods the traditional methods and channels of science popularization such as books, magazines, blackboard notice, are neglected in the communities.

Object of science popularization, generally speaking the ordinary residents in the communities are negative to the science popularization activities which shows as very small part of them attend the lectures(maybe they even don’t know them) or go to “digital harbors” and libraries as most of these instruments are not opened normally and regularly. The other important reason is the activities, lectures, “digital harbors” are not connected with the daily life of the communities, and the local people also are not used to applying some new advanced techniques such as internet, electric books.

Problems existing in the popularization work in community

In this part, we will see the problems existing in the popularization work in community concerning the four aspects, which are mainly appeared as following:

The shortage of subject of science popularization work, there are not full time workers for this kind of work and also the have few opportunities to get professional and academic training. There is not a content support system for science popularization of the community from outside such as government, university, or academic association, etc., as a result the community has no capability to find and choose right, enough and suitable information for routine science popularization work.

Too much attention on advanced channels and neglect of traditional ones of science popularization, such as newspaper, magazines and books which are still the important even the main ways for especially elders and people in rural areas to get science and technology information in their daily life, they are not used to so called “advanced channels” as internet. Ordinary people in community have small chance to participate the science popularization work, usually there is few care about their needs, expectations, feelings and habits concerning science and technology by the traditional popularization way of up down.

Theoretical analysis of popularization work in community

The new orientation of popularization of science

According to the traditional notion, the aim and main function of science popularization (SP) are just how to improve the scientific knowledge level of the public. And of course scientists are only authoritative experts who can popularize the science to the general public, which also supports the opinion that SP is a uni-direction knowledge flow from scientists to public.

The investigations of Chinese civil (from 18 to 69 years old) science literacy (SL) by Chinese Association for Science and Technology (CAST) have held individually in 1992,1994,1996, 2001, 2003, 2005, but only in 2001 and 2003 the reports of investigation were published. From the results of these two investigations we can see that the Chinese civil science literacy level increased obviously with the increasing number of formal education years of the public in school:

Table. The SL level (%) of Chinese people with different formal education stage

Investigation Year / SL / education grade	Under primary school	Primary school	Middle school	High school or prof-school	College	University and above university
2001	0.1	0.0	0.3	1.6	7.0	11.5
2003	0.0	0.0	1.5	6.2	10.7	13.5

Data resource:1 The Chinese civil SL investigation project team, The Investigation Report on Chinese civil Scientific Literacy in 2001, Beijing: Publishing House of Science Popularization, 2002, P60; 2 The Chinese civil SL investigation project team, The Investigation Report on Chinese civil Scientific Literacy in 2003, Beijing: Publishing House of Science Popularization, 2004, P20

In China the general public accepting the systematic science formal education in school is only beginning at middle school stage, which means Chinese people who have just primary or under primary education in school or kindergarten could not get the science education experience, and these kind of people in China are more than 100 millions far more than the whole population of Germany. The SL level of these people, which contributed mainly by SP during their life span from 18 to 69, is nearly zero according to the investigations in both 2001 and 2003. So, if taking China for example, according to several investigations of civil science literacy by CAST, PS in fact contributes very little to the improvement of scientific knowledge level of public especially compared with the formal science education in school.

In fact, general public is not the school student, on one side, they have not enough time and energy to continue to learn so huge amount of scientific knowledge, and on the other side, the interests and needs of public to science are so various and change frequently during their life span that just to improve the scientific knowledge level of public is definitely not a cure-all.

As a result now we'd better get a new orientation of PS today which means instead of asking people to get to master more and more science knowledge, it's quite suitable for PS nowadays to meet various needs of public such as material benefits, recreation expectation, and democracy right etc. concerning science issues in modern society.

The role change of scientist in the popularization of science

Since a long time ago, it's commonly accepted in the science community that scientists should act the subordinate role of the popularization of science. And it's true that in the history of science, scientists always play not only an important but also central role in the PS. Many most famous scientists engaged their lives in popularizing scientific knowledge to the ordinary people as they realized that popular science work was an inalienable part of their scientific research activities. Thanks to their endeavors, more and more general people turned to accept, support, and even like science. Just as Carl Sagan objectively appraised Isaac Asimov in 1992 that we never know how many scientists working at the scientific frontiers got their initial inspiration through a book, an article, or a story written by Asimov, we neither know how many ordinary people support the science at the same reason.

From model (1) which we mentioned in Background, we can see that the information sender sends the information through the communication channel to the information receiver. But, in this traditional model there is a tacit premise which means that information producer is also the information sender, they are the same one. This is common in the general news report, the journalist is both the information producer and the information sender. And it's also the case that in the early time of SP scientists played as both the scientific information producer and the scientific information sender, the most representative figures were such as Galieo, Michael Faraday and also the Royal Society of UK.

However, nowadays the popularization of science has been showing new characteristics. First, in the information and networking society, especially due to the appearance of television and internet, the mass media is playing an increasingly prominent role in the PS as mass media has become the first choice for public getting scientific information on one side, and scientists have to rely on mass media today to do some popular science works on the other side. Second, popularization of science is also becoming a professional area as science communication becomes a major for more and more college students, the content and style of PS also changed too which maybe a bigger and bigger challenge to scientists. Take the content for example, according to an investigation by Royal Society of UK on the attitude of scientists and engineers to science communication to public, "three quarters of the scientists feel able to communicate their own research, whereas slightly less than half of them feel that that they are able to communicate the social and ethic implications of their research ". These new changes will surely affect the ways and traditional role of scientists in the popularization of science.

In the modern activities of SP, we can often see that the scientific information producer and the scientific information sender have been separated. Scientific journalist, as the scientific information sender, more and more faces directly to the public than the scientist, and the latter as the scientific information producer, is often behind the journalist and provides various professional helps to him. So today it's not difficult to see a diversity and specialization trend of subjects of popularization of science.

And then we suggest a new model of scientific communication as following:

scientific i producer→ i ①→scientific i sender→ i ②→cc →i r

i: information
cc: communication channel

model (2)

In model (2), we divide "information sender" in model (1) into two parts: scientific information producer and scientific information sender; and divide "information" in model (1) into two parts too: information j and information k. And form model (2) we still can see the feedback from information receiver to both scientific information producer and scientific information sender, and feedback from scientific information sender to scientific information producer too.

From the new model of scientific communication, we can conclude that mass media workers (including scientific journalists, scientific editors, popular science writers, organizers of popular science work, etc.) who as the scientific information sender will be the main, direct and professional subject of popularization of science. Scientists, while as the scientific information producer, will be the indirect and unprofessional subject of popular science work.

So, the diversity and specialization trend of subjects of popularization of science are unavoidable especially due to the mass media development in this scientific and democratic society, the traditional role of scientist in the popularization activity of science would also be changed accordingly. Scientific community has to face this reality and adapt to the new trend of the SP.

Conclusions and Suggestions

In recent years, with more and more money from government invested into the grass-root units many communities have got advanced hard wares for science popularization works, however with the delay of soft ware construction such as content system, professional training, operation and evaluation mechanism of science popularization, etc., some new problems gradually appear and some old problems are still there in the communities.

Based on the investigations and analysis, we give some concrete suggestions for the future development of science popularization work in community, mainly as: Training professional workers annually for the science popularization in communities, and also training scientific journalists, writers and exhibitionists for communities.

Providing science contents steadily from scientific authorities for the communities such as building science popularization content database or S&T medias, which also should concern with the daily life of different communities. Building up various communication channels for science popularization including both advanced and traditional ways in communities. And lastly inviting local people of the communities participating in the program and evaluation of science popularization work as the bottoms-up way asks.

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41. Science and Technology in TV: the cases of Greece and Cyprus

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Abstract. This paper aims at a full mapping of TV science programs in Greek speaking media (i.e. Greek and Greek-Cypriot media) as well as at linking some critical structural characteristics of these programs (i.e., format and content) with audience reception. The study constitutes part of the European funded (FR7) project "Audio Visual Science Audiences-AVSA" coordinated by Free University of Berlin which conducted a structural analysis of science programs in 13 European member states and investigated their reception by different segments of the public.

Keywords: Audience data, Public perceptions of science programs, Science and technology programs

Introduction

The principal objectives of this study were: (a) to identify and classify science television programs in Greece by type; (b) to correlate audience data with science program types; and (c) to investigate audience responses to specific program types.

In most of the EU member states, there are several weekly television programs on science. Alongside programs comprising reports and discussions of new developments in science generally, there are programs with a more restricted focus, e.g. on astronomy, and there are big-budget documentaries on major topics. The level of production of such programs varies very considerably across Europe. In Greece, there are currently under 20 TV programs about science, technology and health produced by both public and commercial channels. In other European countries such as Germany, there are more than 40 television programs dedicated to science and technology, many of which have been introduced recently, and that number does not include health/ medicine programs (AVSA, 2010).

Television science reinforces the legitimacy and sacredness of science (Dunwoody, 2008). This is due to the way science is presented, as producing solid, straightforward mostly positive results, as well as how scientists are presented as experts and quite apart from other professionals. Evidence presented in the Special Eurobarometer survey, Scientific Research in the Media (European Commission 2007) reveals that the strongest preference among sources for information on scientific research was by a wide margin for 'traditional TV channels' – 34% in the EU, ranging from 27% in the UK to 62% in Greece. However, in the whole of Southern Europe (Greece, Cyprus, Spain, Italy, and Portugal) and also in Eastern Central Europe there are relatively few science programmes (AVSA, 2010). This is most likely not because the audience would be less interested than in other places but the lack of provision is a result of the precarious financial situation of the public service broadcasting sectors in these countries.

The current study constitutes part of the European funded (FR7) project "Audio Visual Science Audiences-AVSA".

Method

Identification and categorization of science programs

The sample contains all science programmes broadcasted within three reference weeks in 2007 and two in 2008. Programs were selected: (a) if the words 'science', 'research', 'knowledge', 'technology', 'computers',
'environment', 'health/medicine', 'discovery' or the name of a scientific discipline (including social sciences) were in the title, subtitle or description of the programme in guides or the internet; (b) if they were on the webpage of a channel under a category whose title contained clear references to science, knowledge, technology, medicine, environment or the name of a scientific discipline. The programs were categorised by type according to the following typology. Popularisation programs (documentaries) typically present science in a factual and informative manner, often consisting of interviews accompanied by narration. Topic areas can include astronomy, engineering, history etc. Advice programmes give advice on healthier living or how to save energy tend to involve lay people. Selection of topics is guided by the necessity to provide the audience with practical tips. Edutainment programmes. The agenda is not guided by science observation but by the aim to educate and entertain the audiences. However, scientific explanations are typically only a minor part of the programme and personalities such as artists or sportsmen often dominate the

scene. Typical examples of Information programmes are science news broadcasts which are characterized by short preparation time and specialization in observation of current events within the science system. Advocacy programmes focus on happenings stemming from social systems other than science, especially politics. Environmental protection is a central topic in this programme type.

Audience data

TV ratings were collected for each science program broadcasted in Greece and Cyprus from a private media research company keeping a systematic data base. Socio-demographic characteristics of the audience were also collected (age, gender, educational status).

Focus groups

The purpose of this part of the study was to elicit participants' judgments about the three clips shown as representatives of their corresponding types and identify the criteria or the ways in which they make these judgments. Participants with specific socio-demographic characteristics were recruited for the conduct of eight focus groups.

Table 1. Composition of the focus groups

Group	Description
Group 1	Participants of mixed gender (preferably balanced) recruited from vocational schools, under 20 years old.
Group 2&4	Participants of mixed gender (preferably balanced) recruited from lists of science teachers, amateurs scientists, science museum visitors, etc.
Group 3	Participants of mixed gender (preferably balanced) recruited from upper secondary schools, 15 to 17 years old.
Group 5	Participants of mixed gender (preferably balanced) who are well educated (university degree), between 30 and 49 years of age.
Group 6	Participants of mixed gender (preferably balanced) who are 50 + years of age, well educated (university degree).
Group 7	Participants of mixed gender (preferably balanced) who come from mixed educational backgrounds and are between 30 and 49 years of age.
Group 8	Participants of mixed gender (preferably balanced) who are 50+ years of age and come from mixed educational backgrounds.

Participants were recruited after responding to a screening question 'how would you rate your interest in science? If participants responded with 'very interested' or 'quite interested', then they were asked a series of questions regarding science related science activities and how often they engage in them ('Do you regularly, occasionally, hardly ever or never…? a) Watch TV programs about science, b) Listen to radio programs about science, c) Buy specialized press about science, d) Look on the Internet for information about science, e) Read science articles in general newspapers and magazines). Sessions lasted approximately 2 hours. The stimuli were presented to the participants on the TV set and the whole discussion session was recorded. Moderators attended a training workshop organized by professionals in the field before conducting the focus groups discussions. The stimuli used during the focus group discussions were broadcasted in 2008 and 2009. One stimulus from each type was presented. This typology is a continuation of the work by Lehmkuhl (2007).

Type 1–Science news report: This clip was part of a news program, lasted for 2.5 minutes and it discussed a medical advance i.e. a cure for individuals suffering from Type I diabetes. The report included statements from researchers and diabetes experts from the U.S. and Greece. Type 2–Report on big issues of science: The program chosen was an episode of a documentary series called "The universe I have loved". The clip dealt with whether there was ever extra–terrestrial life on Mars. The presenter is a scientist who takes the audience through the latest scientific discoveries on this topic. Type 3–Report on scientific explanations of the everyday world: 'Analyze this', is a weekly program presented by a psychologist who discusses topics stemming from "how and why" questions of our everyday experiences. The clip presented dealt with the issue of "why we need sleep" and explains what happens during sleep,

sleep stages and sleep disorders based on latest scientific findings and lasted approximately 3 minutes.

Results

Program types

Nineteen science programs were identified in Greece and three in Cyprus. The majority of programs were related to health/ medicine but the rest touched a variety of topics such as the environment, the universe etc. In Greece, we identified 9 Popularisation, 8 Advice and 2 Advocacy programs. It is worth noting that there is a complete lack of edutainment, which in most of other European countries has become extremely popular and information programs (AVSA, 2010). All three programs broadcasted in Cyprus, were Advice programs.

Audience data

The viewership data show that the available science programs are watched by relatively low percentages of the population. Due to the lack of a large variety of different types of programs and the low audience numbers in Greece and Cyprus, it is difficult to determine whether different segments of the audience (age groups, educational background, gender) have different preferences with regards to the type of program. However, in Cyprus, a country whose population is slightly over 1 million, the average number of science program viewers is 17.000, of which 12.333 (72.5%) are over 50 years of age.

In Greece (potential viewers: 9.356.888 individuals) data revealed that advice science programs related to health and medicine have on average more female than male viewers. Moreover, the majority of viewers of programs related to health and medicine are over 50 years of age. In contrast, documentaries have more male than female viewers while advocacy programs have an equal number of male and female viewers. On average, science programs have more viewers with a medium education followed by viewers of a low education while there are fewer viewers of a high educational level. It might be the case that the size of an audience is more determined by scheduling than by different preferences expressed by the public.

Specifically only three programs were scheduled within prime time zone (9pm-12pm) while three programs are scheduled in the after midnight zone (12pm-6 am), seven programs in the morning zone (6am-13pm), six programs in the early afternoon zone (13pm-17pm) and three programs in the pre-prime time zone (17pm-21pm). This finding does not necessarily support the notion that the audiences just watch what producers want them to watch, or that audiences must be considered to be passive consumers of what is scheduled on their preferred channels. However, it highlights the need to perform an in-depth analysis of the factors which influence viewers' preferences.

Table 2. Audience data according to program content (absolute numbers)

Content	Average number of viewers
Health programs (7)	62.000
Space (2)	32.500
Generic science (2)	32.500
Environment (5)	31.000

Table 3. Audience data according to program type (absolute numbers)

Type	Average number of viewers
Advice (6)*	69.000
Popularization (9)	31.222
Advocacy (1)*	24000

missing data from 1 Advocacy program and 2 Advice programs

The majority of science programs in Greece are related to health/medicine which is evident even from the titles e.g. 'Secrets to good health', 'Health for everyone', etc. The environment is also a very popular topic e.g. 'Eco news', 'Ecology and diet', 'Thirsty planet', etc. There are some programs concerned with the universe or space e.g. 'The universe I have loved' and 'The sensitive universe'. A small number of mini-series programs deal with different scientific issues 'Magically simple' or 'Science Nova'.

Clip assessments

Clip 1: Science news report

Content: The majority thought that the medical breakthrough is interesting and worthwhile to present during mainstream news since a large portion of the public might be directly or indirectly affected (Group no. 1, 5, 6, 7, 8). The only criticism received was from younger participants who supported that the issue was not analyzed in depth and thus narrowed the intended audience to those affected by diabetes, experts or families (Group no. 3). Participants judged the best feature of the clip to be that scientists had the opportunity to talk about their research and what it means to them. Also, that it gave information on what would be the latest news from the medical community. They thought the information provided was better documented as experts were talking about the issue. Participants found the clip aimed to inform people about the direction research is taking however it also transmitted a feeling of hope.

Way of presentation: Participants thought that it was a good choice to present this topic with many speakers and expert opinions within a working environment i.e. lab. (Group no. 5, 6, 7, 8). One participant said "It was very forward of them to use 3D animations in a news clip" and commented on the role the scientist had in the clip "Did you see the scientist in the lab? They made an effort to present the scientist in a different light" (Group no. 2). However, other participants felt that the information presented was not understood by everyone and that the only information essentially offered is that the therapy for diabetes is very close. Some participants from group no. 2 thought that medical breakthroughs are presented in news so often that they have sort of lost their credibility. Also, that there was a fake air of "scientificness" about this clip such as the presence of some terms and images and this was a negative aspect to this reportage according to the participants. This was attributed partly to the fact that the journalists presenting the topic were not scientists themselves and partly due to the way of presentation – quick pace, a lot of information etc.

Context of media output production, its effect on public awareness of S&T: Participants from mixed educational backgrounds aged 50 + pointed out that reporters of health issues (or science issues in general) should be specialized in this–not just any reporter (Group no. 8). Moreover, it gives people the motivation to search in depth about this topic (Group no. 7). Some participants felt that the medical breakthrough should not be presented as if the solution is already there and give false hope "There is an ethical dilemma however–scientists have responsibility when presenting a health topic" (Group no. 2). Participants also mentioned that news is usually presented in an overdramatic way because the program broadcasters sometimes are more interested in triggering a sensation rather than presenting credible information i.e. this can have the effect of scaring people–the example of the flu vaccine H1N1 was given (Groups no. 1, 3). One participant felt that the media "use" medical breakthroughs to create a sensation (Group no. 7) and that it would be much better to actually announce a breakthrough when it is already used or applied rather than announce something which is still under investigation and give people false hope (Group no. 7).

Clip 2: big issues of science

Content: Participants thought the clip was interesting as it was not narrow in focus but rather approached questions which have preoccupied scientists for a long time "interesting and larger than life' (Group no. 5).

Way of presentation: Participants made quite a few negative comments regarding the presentation style. Specifically, participants thought that the two professors presenting the program had not been advised by TV people so that the end product is more appealing to the audience. "The presence of scientists contributes to the reliability of the program. But experts are not experts in communication! I understand that programs are presented by scientists to enhance status but in this case they should receive some training on communication" (Group no. 2). The majority of participants felt the tone was "didactic" and the presenters spoke "painfully slow". They thought that this production is actually representative of Greek state TV and if this was presented by SKAI, a private channel it would be much more interesting. Younger participants judged the clip to be boring and the effort to dramatize the issue it dealt with not successful at all "this music they use, it is like a thriller, spooky" (Group no. 3). Participants did not doubt the credibility of the images presented in the background. This could be attributed to the fact that the images presented behind were not so sophisticated i.e. 3D graphics etc. but mainly showed generic images from space. None of the participants doubted the status of the scientists and the information they conveyed. The majority of participants irrespective of age and educational background judged the fact that the program was presented by professors who knew their field of study well as a positive thing. In fact, some mentioned that this was indeed a scientific program with real scientists "Purely scientific. It encompassed history of science, methodology and began to answer a scientific question" (Group no. 2).

Clip 3: scientific explanations of the everyday world

Content : The majority of participants felt that a daily life topic is much more personally relevant and accessible to everyone compared to other scientific topics such as big issues in science.

Way of presentation: Participants both criticized and praised the set up of this clip. Younger participants especially thought that it was much more memorable since there was a quick pace, easy language and that the topic was approached in a way so that no issues were unaddressed (Group no. 1, 3). Others judged the program structure positively as it went from general to specific, it was of short duration and there was limited information presented on a single topic in a concise way (Group no. 5 and 7).

All participants thought that the summary points presented at the bottom of the screen were really helpful for viewers so as to retain information better. It was mentioned that the program was successful as it combined image, sound and text. Others felt the strong point was that the presenter mentioned results from research studies (Group no.

8).

However, participants also commented that this program seemed more like an advertisement or that it was like opening up an encyclopedia. They thought the format of the program was unsatisfactory as the production team cannot expect the audience to "have an appointment with the program" i.e. go out of their way to watch this program since it only lasts 5 minutes. A program of such short duration does not have such a strong identity – no viewer will rush home to watch it as there is such a huge possibility that viewers might miss it (Group no. 7) however a healthy young person is very suitable to give health related advice (Group no. 7).

However, most participants heavily criticized the clip as they felt that this was a cheap production only based on the appearance of the presenter "the particular presenter was chosen because of her looks and because she would attract more viewers". Furthermore, most participants thought that she was not convincing in her role "these programs should be presented by a scientist so that the information is correct and credible" (Group no. 3).

Conclusions

Research findings indicated that there are few science programs broadcasted in Greek and Cypriot TV of which most are popularisation and advice programs while there is complete lack of Edutainment and Information programs. Another important observation is that the scope of topics used is very limited. The majority of programs concern the areas of health/ medicine and the environment. Furthermore, science programs audiences are very low. However, older viewers and of lower educational background tend to follow health related programmes falling within the “advice” type in a more systematic way.

Findings of the focus group discussions indicate that the majority of participants believe that the production and broadcasting of science programs is primarily the responsibility of public channels. However, most of the science programs in Greece are broadcasted by a single, private channel and mainly produced abroad. Findings also show that participants have a set of specific criteria according to which they judged scientific programs. These included personal relevance of topic, the presentation/set up of the program, the presenter/scientist presenting the program, the scientificness and the reliability of the program. Some differences were evident between different segments of the public. For example, reliability of the presenter and the information was more important to participants with a higher education while younger participants were more concerned with the presentation of the program. Content was a relevant criterion for all participants however, participants with a higher education judged the big issues in science clip and the science news report clip in a more positive light. Conversely, participants of a lower educational background judged the clip on scientific explanations of everyday world more positively. These findings could open up the road for benchmarking S&T presence in TV as well as contribute towards a better understanding of the elements different segments of the public would appreciate.

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42. Reviewing Science Education Reforms and Science Literacy for All

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Abstract. There is need for creating a universally scientific literate society through "Science Education for All". What is needed in this regard is to popularize science and consumerize technology. The presentation gives a brief analysis of the definitions of scientific literacy in relation to language literacy, dimensions of scientific literacy in the contexts of sustainable development and understanding of science as a social enterprise .It examines the role of science, technology mathematics education into a human enterprise for creation and sharing knowledge and developmental capacities to design envisioned future technologies for the benefit of mankind for peaceful co-existence. World science declaration 2000+ is corner stone of policy frameworks for reforms for science, technology, mathematics education for all. Some suggestions for Common curriculum changes are diversification, International competitiveness and issues of ethics and public understanding of science and technology and expected education reforms for promotion of scientific literacy at every level. Recasting the science, technology, and mathematics education for more relevant to needs, aspiration and interest of society is essential for popularization and communication of science and technology.

Keywords: Science and technology, Scientific literacy, Science Education for All, Science, technology and mathematics, Science, Mathematics and technology education, RMSA, NCAER, ISCA, IMSS, INSA

Introduction

The Importance of science and technology (S&T) in every aspect of our lives in progressive nation like India has been restated many a times in important S&T resolutions (1-3). As the world becomes increasingly more and more scientific and technological increasing one's scientific literacy (SL) is very important. The future of mankind depends on the enhanced effectiveness of education for growth of scientific literacy and its application especially for making personal and collective political decisions that can sustain our economy and democracy. We need to create a universally scientific literate society through "Science Education for All" (SEFA) the guiding principle in this regard is "popularize science and consumerize technology.

The American Association for the Advancement of Science (4) defined scientific literacy as the ability to use scientific knowledge and ways of thinking for personal and social purposes. Attempts have been made to define scientific literacy in relation to language literacy by several educationists (5-8). Despite some differences, whether scientific literacy is not dependent or dependent upon any specific science content or process knowledge the dimensions of scientific literacy include the following.

- Science content: understanding facts, laws, concepts and theories
- Scientific inquiry: understanding of the scientific approach to inquiry
- The ability to define scientific study and to discriminate between science and non-science
- Equal importance of science content and science processes equally
- According to Project 2061 scientific literacy (9) has many facets. These include (i) familiarity with the natural world and respecting its unity; (ii) awareness about the important ways in which science, mathematics and technology Education (STME), depend upon one another; (iii) understanding some of the key concepts and principles of science; (iv) developing capacity to understand the scientific ways of thinking and its importance;

  (v) knowing that STME are human enterprises, and (vi) understanding the implications about their strengths and limitations. All most all, subsequent definitions (10-12) of scientific literacy have been weaved around these facets.

Third International Mathematics and Science Study (13) (TIMSS) defined few additional objectives in this regard, viz.:

- Education for universal science literacy will, in addition to enriching everyone's life, create a larger and more diverse pool of students who are able and motivated to pursue further education in scientific fields.
- The first priority of science education is basic science literacy for all students, including those in groups that have traditionally been poorly served by science education.
- For students to have the time needed to acquire the essential knowledge and skills of science literacy, the sheer

amount of material that today's science curriculum tries to cover must be significantly reduced.

- Effective education for science literacy requires that every student be frequently and actively involved in exploring nature in ways that resemble how scientists work.

STME for Sustainable Development

The understanding science as a social enterprise (14-15) is necessary for sustainable development. The broad access to scientific information is key for the people to understand, participate and respond to the challenges that development poses to civilization. Understanding of issues such as environment, global warming and climate change, air quality, loss of biodiversity, evolution, implications of genetic research, human health, hazardous substances, population growth ,world hunger, water resources, energy security, degeneration in agriculture and many other topics is essential, almost a requisite, for personal involvement in searching solutions for these issues. Thus education with science, technology and Mathematics (STM) base is crucial to sustainable development. It is challenge for science educators all over the world to converge STME into a human enterprise for creation and sharing knowledge and developmental capacities to design envisioned future technologies for the benefit of mankind.

Science Literacy for All (SLFA)(16)

- World Declaration on Science 2000+: "The declaration on science and use of scientific knowledge is part of the right to education and right to information belonging to all people for human development and creating of endogenous scientific capacity".
- There is need to improve, strengthen, diversify and restructure STME both formal and non-formal with the objectives for sustainable development.
- STME can contribute to peaceful co-existence. It should not be seen as an instrument of warfare. It can be used as knowledge for conflict resolution by including subjects such as energy, pollution, environment, health care, medicine and use of resources and application of bio-technology, nanotechnology and nuclear energy for peaceful purposes.
- The society and Government must take responsibility for the same because the STME's spirit and scientific temper in society can contribute to respect for human rights and dignity of labor.

Post Sputnik Science Education Reforms

The main emphasis of the above reforms (17) undertaken during 1900-1950 were teaching of science as structured discipline to limited students in what, why, How, types and content of courses. The focus was not SLFA. But in India Kothari commission report (18) stressed need to transform education as per the needs and aspirations of people and focused on education as key to national development and importance of science education in this regard. The Kothari commission report expounded "Science has added new dimension to education and its role in the life of the nation, but central to all this is the quality of education. If science is poorly taught and badly learnt, it is little more than burdening the mind with dead information and it could degenerate even into a new superstition. What we desperately need is improvement in standards of science education at all levels".

Three major goals of STME identified were in the report viz:

(a) Prepare excellent Scientists (b) Training of teachers in new frontiers of knowledge

(c) Produce scientific literate society. It shifted emphasis from knowledge process to skills and attitude of mind and also interaction between worlds of knowledge with the world of work.

However, few distinctive drawbacks of these gigantic efforts were noticed as a result teacher proofing of curriculum, over emphasis on computer assisted learning, loss of interest of students in science and mathematics, and domination of university and research scientists alienating initiatives of school teachers in classroom situations. The assessment and evaluation did not receive a proactive support of scientists dealing with the reforms also. However, it impacted the thinking of scientists and educators equally in third world countries and brought together scientists, educators and teachers at all levels on a common platform for new resurgence characterized by sharing of knowledge and experience for worldwide paradigm shifts in approach to STME

Revival of STME at National Level

The State of STME is at center stage again at national level because of global concerns for sustainable development, economic growth, better quality of life and "science education for all"(SEFA).

The second reason is renewed importance of basic sciences as expressed in the statement of Nobel Laureate

Aaron Ciechanover at ISCA 2007. He made an appeal for global focus on basic sciences rather than application for the research being funded. "If you don't have basic science, there is no applied science". Similar sentiments were expressed by science fraternity participating in INSA Initiatives on improving science teaching viz.

- Science education seminar, INSA–May 2002(19)
- Science education INSA Workshop–Oct 2002
- INSA report on science education in universities and Inter Academy discussions on improving science teaching.
- The national curriculum framework 2005 has elaborated the goals of S&M curriculum for schools.
- The recent NCAER 2005, India Science report gave the picture of state of science education in India.

All these reports examined various conceptualities for improving STME in India including poor quality of education, lack of experimental facilities, absence of good quality teachers, need for attracting good talent and removal of inadequacies in curriculum.

A brief overview of the science curriculums, textbooks, and teaching continue to lack focus and to emphasize quantity over quality. The definition of literacy must expand to include not only reading and arithmetic, but also science, mathematics, and technology. The life-enhancing potential of science and technology cannot be realized unless everyone understands the nature of these subjects and acquires basic scientific habits of mind. Without a science- literate population, the outlook for a better world is not promising. The STM education is considered an important component of science education (SE) in schools from K-1-12 levels all over the world to promote SEFA in view of universalization of secondary education(21) under Rastriya Madhymik Siksha Abhiyan (RMSA)-2009(22-23).

State of STM Education in Schools in India

The recent NCAER 2005, India Science report (24) gives the picture of state of science education in India. Some of the facts in this regards are:

- It is well known that good talented students are not opting science courses. It is worldwide trend and India is no exception.
- After 10 + 2 students enroll for B.Sc. degree only if they fail to get admission to courses like engineering, medicine, and commerce. Only 25% of entrants in K-12 system complete science courses. 10% recipients of National Talent search scholarships opt for science courses. The Percentage of student joining science has declined from 31% to 23.3% since 1990.
- Studies are not enjoyable and cannot attract students and there is dearth of good teachers. And the cost of higher education in science is higher and non-affordable. The infrastructure and laboratory facilities are in adequate also
- absence of brand institutions and resources for up-dating of learning material, laboratories, teacher training, lifelong professional development of teachers and promotion of basic research in methodology of science teaching.
- Limited job opportunities offered by the courses in vogue in school education i.e. vocational chances are limited at terminal level school science education.

Changes are also needed to meet requirements of science teaching post 2000+ such as competency in digital literacy skills in using learning technologies, knowledge of problem solving tools, inventive thinking along with marketable and practical skills applicable in effective communication.

Policy framework for STME

- The World science declaration 2000+ is corner stone of policy frameworks (20) for reforms in STME. These principles have guided the directions of developments in the field STM education in this decade.
- Science literacy for all–"no child is left" and the inquiry based and exploratory method for learning SE is used so that learner himself can construct the knowledge.
- STME can contribute to peaceful co-existence. It should not be seen as an instrument of warfare. It has to be all-inclusive to ensure gender equity, participation of all including marginalized groups, and impact of globalization, public understanding and its influence in daily life, concern for ethics, human rights and culture of peace.
- Teacher is the vehicle for desired reforms in SE. The institutionalized training (pre-service and in-service training) of teachers and their professional development must receive a central place in resource planning.
- Financial and resource inputs are necessary for developing an enabling environment for science learning.

Integration of IT and communication technology in curriculum transaction for effective learning and lifelong learning.

Objectives of Common curriculum changes

- It provides knowledge of concepts and related broader contexts of STM and presents a balanced view of contents and applications. It connects facts and understanding of the factual material which includes observation, inference and application of the subject. It should helpful in inquiry-based learning and experimentation. The Curriculum changes to include history of scientific discoveries and role of STME in everyday life to make learning enjoyable also. Simultaneously it integrates with other curricular areas such as reading, writing, business and social studies.
- Laboratory experiments provide linkages between theory and practical, as well as, facts and applications. It reflects the interdisciplinary nature of STM. It is inclusive of hand-on inquiry-based activities or experiments aimed at problem solving in social contexts using examples.
- Develops appropriate science experience based on visits to industry, environment and agriculture, so that it develops a global perspective of STM for sustainable development and improved quality of life. Its digital age, so it must enhance competence of students in information comprehension, use of computers for simulation, use of multimedia tools, Internet sources for data collection and virtual learning.

Diversification of STME(20-21)

- Undertake structural reforms to improve strengthen and diversify STME to integrate with culture, promote open and critical thinking and enhance people's ability to meet the challenge of knowledge society.
- Diversify STME for many fold objectives: (a) science literacy, (b) science for skilled work force and service providers, (c) cadre of excellent scientists, through child centered knowledge and inquiry based learning (d) spreading science education in rural areas and building bridges with traditional knowledge.

STME for International Competitiveness and Ethics

- Since the science education is necessary for training of sufficient number of trained people to satisfy the scientific and technological needs of the global society, capacity building in science and scientific culture is of utmost importance.
- Ethics and human rights and necessity for culture of peace and tolerance, advancement of communication and information technology has brought human races much closer. There is need for developing understanding of globalization, sustainable development, and willingness to acquire knowledge, skills and attitude towards responsible citizenship.

Public understanding of STME at every level

- To ensure the power bestowed on human being by science is used for benefit for all and not for few.
- In developing countries, under investment, lack of policies and constant follow up activities is most importantly causing shortage of qualified teachers, appropriate teaching material and adoption of new technology as serious handicaps. All efforts are made both at national and international level to make science education internationally competitive at every level. It is necessary for meeting the challenge of globalization and trade in services of education.
- Scientific temper is guaranteed against the forces of religious fundamentalism and obscurant and dead traditions.

STME–More Relevant to Needs, Aspiration and Interest to Society

- STME for all round development (20) encompassing, intellectual, personal social and economic development as core subject at all levels to meet the needs of students for future citizenship, enabling them informed and appropriate choices about learning and career development.
- To enable students for adequate preparation for 21st century to meet present and future social needs. The changes made in the Curriculum on above counts and improvement of quality must be accompanied by concurrent changes in methods of delivery, teaching practices and learning resources.
- Inclusion of IT and computer applications as a core areas of study and sustainable development, concern for human rights, sharing of resources for quality of life for all social responsibility.
- Diversification of effective practices of STME for promotion of innovation and experimentation as part of learning support inter-alias formal and non- formal education.

- Outside class or laboratory learning through field visits, science museums, exhibitions, science projects presentation, quizzes, etc.
- Student Centered Learning and teaching in classroom and laboratory.
- Defining classroom and laboratory activities based on investigation of real life problems.
- Learning to be assessed based on how the learner uses the information and skill in constructing one's own knowledge based on investigations on relevance of STME to local environment. Development of life skills through STME is more important than only professional skills.

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43.From 'Understanding' to 'Engagement': The Road Ahead for Public Participation in Emerging Technologies in India

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Abstract. As India launches itself on a development trajectory in nanotechnology and other emerging technologies, and with agricultural biotechnology being around for some time and fuelling many controversies, the time might be opportune to review the role of public participation in framing science and technology policy in India. Social and political theorists, public interest groups, scientists and policy makers, particularly in the developed world, has widely embraced the concept of increased public engagement in science and technology on the premise that 'public participation makes for better science and science-based policy'. In India, however, till date, we see a privileging of 'public awareness' over engagement. As enunciated by India's Science and Technology Policy, 2003, one of the main policy objectives has been 'to ensure that the message of science reaches every citizen of India, man and woman, young and old, so that we advance scientific temper…' Thus, as India has engaged with new technologies such as agricultural biotechnology, nanotechnology etc., the government policy has been oriented more towards communicating science than actually engaging in a dialogue with the people on defining the course for the future. This could in some measure, be attributed to what many critics refer to as the overbearing attitude of the Indian state in its deployment of science and technology for nation building, with public participation becoming more a means of legitimizing science rather than creating room for dissent. At the same time, one can never underestimate the immense challenges for the Indian scientific establishment in communicating information about new cutting edge technologies, to a very diverse Indian population at different levels of educational and economic status. Age-groups, gender, residence in urban or rural areas is some other factors which a science communication strategy always has to keep in mind. Some of the recent developments, particularly in the context of the GM debate, can lead one to an interpretation that India is taking the first steps towards more participatory public involvement, and a tenuous engagement with diverse and dissenting viewpoints.

This paper seeks to review the current state of public participation in Indian science and technology, particularly in the context of the agricultural biotechnology and nanotechnology as well as examine the challenges and opportunities in taking the leap from participation to engagement. The methodology includes desk review of policy and legal documents, science and technology studies literature, media reports as well as focus group discussions and indepth interviews with scientists, ordinary citizens both in urban and rural areas etc.

44. Ritual Models of Risk Communication

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Abstract. Risk communication plays a crucial role in the today's public controversies on science and technology development. The dynamics that emerge in the communication between the different stakeholders involved in this kind of debates, however, have not been fully understood yet.

Three-actors, one-way communication models, such as the well-know "deficit model"–where the information flows in a line from the experts to the public, through the mediation of the mass media–fail to explain the complexity of the communication processes inherent in typical real controversies, in which the relevant information about risk is produced and spread by numerous stakeholders, i.e. not only by scientists and journalists, but also by environmental associations, citizens' committees, private companies, consumers' association, political parties, NGOs and many others.

At the same time, the "dialogue model"–that engages publics in two-way communication–appears to be not more than a prescriptive model, indicating how communication between experts and publics should be carried out, rather than describing how it is really carried out in a typical public debate.

What we most need to describe the complexity of the risk communication processes in a real controversy is a multi-actor and multi-directional theoretical model for public communication in which the relevant information about risk is produced and shared by numerous stakeholders, whose communication strategies are adapted to the different goals and audiences.

Moreover, numerous historical case-studies indicate that this kind of debates is not limited to the close examination of techno-scientific aspects, based on techno-scientific knowledge, but focuses on a clash between values and world-views, in which beliefs, interests and alliances play a vital role.

Both deficit and dialogue models are classical transmission models of communication, and they concentrate on three actors: the sender of the message, the transmitter, and the receiver. This transmission view of communication is the commonest in all industrial cultures and it is defined by term such as "imparting", "sending", "transmitting", or "giving information to others". Dialogue model, defined by the term "listening", adds bi-directionality at the flow of information, but it remains essentially a linear model.

Nevertheless, in a risk communication scenario, it could be useful to explore as well non-linear models, such as the ritual model of communication, characterized by terms such as "sharing", "participation", "association", "possession of common values". A ritual view of communication is directed not towards the act of imparting information, but towards the representation of shared beliefs. Ritual model can be thought of in terms of a "theatre of communication" and seems to be more appropriate in describing the dynamic communication networks between the social actors taking part in the today's public controversies on science and technology.

In the present work the author explore the opportunity to develop a descriptive, multi-actor "ritual model of risk communication" aiming at offering more insights into the comprehension of typical risk-benefit controversies and the development of more effective strategies on risk management, with particular regard to science-based decision-making.

45. Learning Science in Informal Environments

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Abstract. In India 70% rural population depends on agriculture and women are plays a vital role. They have extensive work load with dual responsibility for farm and house. In agriculture and allied industrial sector employs as much as 89.5% of the total female labour however their contribution does not receive due recognition. And they are not able to reap the benefit of various rural developments programmed. The development of India is burdened by its low productivity, inadequate use of available technological tools for improved crop production. Transfer of technology from research institutions should reach the users. Science and technology have been an integral part of Indian civilization and culture. Women and men have been active in science from the inception of human civilization. We have to make our communication more interesting and interactive "Still there is a lot to be done to fight the superstition and religious rituals that so deploy ruled in to village life.

Some time we do not have sufficient infrastructure to make our message effective enough, and people continue to trust witch doctor move them real doctor. So, public communication is the only way that can help them not only information discrimination but also to augment the pace of economic development. Women's education is strongly associated with both lower infant mortality and lower fertility, as well as with higher levels of education and economic opportunity for their children. Hence a country to grow was through empowering of its women. Public communication aims to popularize science and create scientific attitude among masses. It seems to intriguing to link the common men with a complicated subject like science. The solution like hunger poverty malnutrition illiteracy conservative ideas and superstition lie in science. It can be overcome through SSG.

Now in India a newer way to organize their rural poor in particular women from farmer family as self help group (SHG). SHG concepts are influential in SHG concepts are influential in providing education on modern science and new technologies. A typical SHG has 15 to 20 members. Each block organizes five hundred to 1000 such groups. We can communicate information through workshop and training to develop a technological temper throughout the member and their families which can help us to achieve our objective.

Training method should be adjusted to the level of literacy and domestic obligation of the member. The objective should be to enhance production and improve welfare and socioeconomic condition. Training should change the attitude of member. Hence, a need arises to carry out studies in order to understand and set right their disbeliefs, negative attitudes and misconceptions. Education is one of the most important means of empowering women with the knowledge.

The present paper deals with the experience in technology transfer to rural women in different farm based activities. In all the activities women SHG were involved. They were empowered through this training programmed in a participatory manner. "Today nobody has claimed to be literate unless he possesses knowledge of science" J. L. Nehru.

Keywords: agriculture, rural women, Self Help Groups, technology transfer

46. The Benefit of Volunteering Service in Science Communication

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Abstract. The level of Scientific and technological innovation is an important expression of a country's comprehensive strength. Science is not only a profound paper in the magazines like science or nature and rely on the cutting edge lab equipments, but more depend on the desire from all the populations. Having the fertile soil, definitely would bear the rich fruit, the formation of atmosphere for knowledge desire can't exist without the communication and popularization of science knowledge. There are many ways to promote the propagation of science, for example science exhibitions and public media and so on. Science volunteer is a unique carrier and a bridge between the science and the public when they are serving in the science communication, their role can't be ignored. The volunteers themselves would be the direct receiver and practitioner while they are popularizing the science knowledge. They will bring the knowledge into their daily life virtually and influence the people around them. This essay tries to analyze the uniqueness of volunteer as the bridge between science and public in order to reveal the role they are playing.

Keywords: Science communication, volunteering service, volunteer

47. A Discussion on the Plateau Pattern of Reform

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Abstract. This article puts forward a new form of science popularization in the countryside, which is to target individuals and groups, to integrate current scientific resources and provide tunnel-like scientific service in a direct, controllable, effective and sustainable way and at the same time set up good examples and make use of their radiant effect in this process. This paper focuses on the structure, the operation and characteristics of this form. It also analyses the possible difficulties and prospects for its future development.

Keywords: Science popularization; Plateau pattern of reform; Dripping and pouring form of irrigation

48. Create Your Own Sustainable City–SymbioCity Scenarios

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Abstract. SymbioCity promotes holistic and sustainable urban development–finding potential synergies in urban functions and unlocking their efficiency and profitability. SymbioCity Scenarios is a simulator which aims to increase the awareness of some of the numerous possibilities local governments have available to steer their cities towards a more sustainable development. Within this area there are many valid and different points of views and small and large-scale solutions depending on various conditions and cultures. Simulation exercises have successfully been carried out with local politicians/civil servants and with high school students in Sweden, Denmark, France, Brazil and China. Available at the following address: http://symbiocity.org/symbiocity-scenarios/

Keywords: Multimedia, Urban planning, Best practices

49. Opinions about Nanotechnology in Dutch Science Cafés: a Qualitative and Quantitative Analysis

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Abstract. It is now widely agreed that it is beneficial for experts and policy-makers to involve citizens and consumers in discussions about possible scientific and technological innovations and their associated risks (Flyn et al, 2009). Recent studies on social aspects of nanotechnology emphasize the need for dialogue, public participation and 'upstream engagement' (Pidgeon & Rogers-Hayden, 2007; Wilsdon & Willis, 2004). Others argue that it is time to pay attention to risks and the consequences of nanotechnology for society (cf. Royal Society, 2004). However, dialogue and upstream engagement are difficult to accomplish since the public does not always participate in science and technology issues (Dijkstra, 2008). Thus, more insight in the relationship between publics and science is needed.

In 2009, the Dutch government started a public debate on nanotechnologies. Amongst others, goals were to engage the Dutch public into nanotechnology and to discuss in a wider circle of stakeholders possible risks and benefits of nanotechnology applications. Within this framework, a collaboration of Dutch science cafés and debating centre Tumult organized a series of five debates (called: the Nanotrail) about nanotechnology and its possible applications. In a final meeting suggestions for a nanodialogue were discussed. In addition to the meetings a research study was carried out. First of all, a qualitative analysis of the science café meetings was conducted and themes and arguments expressed during the meetings were analysed. Secondly, attitudes and perceptions, and levels of participation into nanotechnology of participants of the science café meetings were analysed quantitatively and were compared to a second sample of respondents interested in science and technology but who did not visit the meetings. Results show that science café participants were more positive about nanotechnology than the digital group of non-participants. Both groups did not perceive high risks and mostly see benefits of nanotechnology. A majority of the respondents from both groups did hear or watch information about nanotechnology and talked about it before. On average, the science café participants' levels of participation in nanotechnology were a little higher, but differences between the groups were not significant. Qualitative analysis showed that people would prefer attention for both risks and benefits of nanotechnology. If needed, research should be stopped. Also, from the qualitative analysis it became clear that there is no polarisation of the debate in the Netherlands yet, which offers opportunities for organizing debate and dialogue.

50. Proposals for Societal Dialogue Framing the Controversy: The Case of Stem Cell Research in Spanish Press. El País and ABC (1996-2006)

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Abstract. Scientific advances are opened to democratic processes and how these processes are framed in the media play an important role in shaping science future policy and legislation. The dignity of the early embryo has become the central ethical issue in the public debate over the advisability of continuing human embryonic stem cell research in the last years. Embryonic stem cells are one more promising chapter of biomedical research about future treatment of Alzheimer, Diabetes or Parkinson and from an ethical point of view, these advances implies the intervention in the human nature in the very early stages. Therefore, the answer of the different actors implied and its transmission to the general public, mainly through mass media, will be determinant in future laws and public opinion. In Spain, there had been an important debate, especially from 2002 about researching on frozen embryos and from December 2006 a Law allows researching on embryonic stem cells and therapeutic cloning.

This study presents some proposals to promote societal dialogue between all the actors implied: scientists and researchers, industries, politicians, citizen associations, religious sources… from mass media perspective after going in depth in a content analysis of 2,482 articles collected from the web archives of two prestige daily papers situated in the two extremes of the ideological spectrum: El País (1,497) and ABC (984). The sample is retrieved with the keywords “células madre” and “célula troncal” from 1996 to 2006. The coding sheet has been used in The New York Times y Washington Post. The reliability has been equal or higher than 80 percent in all the variables using Cohen’s Kappa coefficient with 10% of the sample of the American study (841) in a double coding after a training period of the author in the University of Wisconsin- Madison. The variables are frames, main actors portrayed in the Spanish, European and American arena, format, source of stem cell and main topic.

The data shows that the issue is practically absent from the Spanish media in the first years when the most important are scientific advances and the coverage peaks from 2002 to 2004 when the issue turns into political arenas. This coincides with the maximum of the frame “political strategy”. Industrial aspects are absent above 90% with the frames “Market/Economic promise” and “Patenting/property rights”. The peaks of media coverage in El País and ABC about stem cells are identified when the main frames used by journalists are “political strategy”, “new research” and “ethics-morality”. Mass media have focused more on the political controversy about embryonic stem cells than on informing about scientific advances with adult stem cells. Therefore, the political debate has focused the media debate around embryonic stem cells in the 58% of the texts with less attention paid to other sources such as adult (17%), and bone marrow stem cells (7,2%).

II

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51. Summer Scientists Campus: Science as the Basis of Change in the Current Economic Model

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Abstract. The current situation of economic crisis has provoked strong international debate on the validity of the prevailing economic model in western societies in general and more specifically in European ones. This economic model, based on the society of production and globalization, shows signs of serious exhaustion which makes us think that it may need to be modified. Focusing on excellence in education, especially in scientific-technological education, has become a cornerstone of this change towards a more competitive economy based on knowledge, according to what was established in the Lisbon strategy.

According to the data produced by the Eurobarometer in 2005, more than 80% of Europeans believe that young people showing an interest in science and technology is fundamental for the future of their countries. However, it is still surprising that although the number of young people who go to university in most countries has increased over the last few decades, there is an increasingly lower number of students who chose to study scientific-technological courses or carry out scientific studies at stages before University. This trend coexist with a vague and low-valued people's scientific literacy and culture, which are vital to ensure that citizens can understand the challenges and advances which affect modern societies. Besides, if Europe intends to lead the global economy, it needs to train and encourage the presence of high level researchers and engineers.

In Spain, the situation of science and scientific training is not very different to what has been detected in the rest of Europe. In the different studies on Social Perception of Science, carried out by FECYT between 2002 and 2010, the results show that scientific and engineering courses are not attractive enough to young people, even though science and the scientific profession have a good reputation. In other the study carried out in 2010 on young people's perception of science and the scientific profession, the results have shown that teaching sciences in Spanish classrooms does not lead to activities which have been shown to have a high pedagogical value, such as the use of laboratories and carrying out experiments, debates on science and technology or the study of serious environmental and socio-economic problems faced by humanity and their causes.

In view of this situation, the Spanish government, through the Ministry for Education and the Spanish Foundation for Science and Technology, launched the Summer Scientists Campus programme in 2010. The programme was aimed at secondary school students and the main objective was to boost the interest of young people in scientific and technological disciplines through their participation in research projects specially designed for the CAMPUS programme and run by teachers from universities and secondary schools. In this study the results obtained are evaluated and an analysis is performed on the effectiveness of these types of activities to increase the interest of young people in the study of scientific-technological subjects as well as their importance in changing the economic model.

52. Citizen's Agenda of Science and Innovation: An Innovative Scientific Communication Way Towards Citizen Participation

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Abstract. Citizen participation processes in political decision-making have been taking hold in countries where democratic progress (understood in its true etymological sense as the "people's government") has made it possible to extend the concept of citizenship, moving from what is known as a "formal democracy" to a democracy of a participative nature in which the citizens hold, both individually and collectively, true power.

At the same time, the need to become involved in science as a fundamental component of people's culture is becoming increasingly obvious, as it enables us to comprehend reality, understand the world and have more awareness in decision-making related to our surroundings, at both an individual and collective level. As part of this trend, it is essential to recall the words of Barack Obama in his vote of confidence speech on 29 January 2009: “We will restore science to its rightful place”.

To make this integration of science in culture become a reality, it is firstly important to make citizens understand why and how science is made, promoting scientific communication, from both the public powers and the scientists themselves. This is the only way that society will be able to support and understand the work of scientists and the contributions made by the public powers in relation to scientific and technological subjects.

With the purpose of encouraging citizen participation by integrating the three areas of society involved: the citizens, the scientist and the political decision-maker, the Spanish government launched an innovative and unique project in the first half of 2010, during its Presidency of the European Union: the Citizen's Agenda of Science and Innovation. The initiative was designed as a new route in scientific communication in which citizens, in addition to being able to discover the faces behind great discoveries and innovations could pass on their concerns and priorities in the field of scientific and technological research to the European political decision-makers.

The project presented fourteen European citizens whose creations or research form part of everyone's daily life, even though we are often not aware of the extent to which they have changed our lives. Selected by a committee of experts, the fourteen European personalities came up with and formulated the challenges proposed to the citizens, so that they in turn could value and prioritize which should form part of the Agenda of the ministers of science and innovation. Those proposing the challenges included very well-known people such as the architect Norman Foster, the biologist Jane Goodall and the physicist Juan Ignacio Cirac; and others whose names are less recognised, but whose contributions have undoubtedly changed people's lives, like Franck Biancheri (the creator of Erasmus grants), Karlheinz Branderburg (the inventor of the mp3) and Matti Makkonen (main contributor of SMS)

The citizen participation process was centralised on a website, www.reto2030.eu, for one month and received votes from more than 100,000 citizens. The final result was displayed to the European ministers of science and innovation during the Competitiveness Council which took place in May 2010 using a scoreboard located in the hall of the European Council in Brussels.

53. Communicating Climate Change Through Interactive Dome Visualization
– Frameworks, Potentials and Challenges

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Abstract. Climate change is one of the most fateful questions of our time, largely affecting the general public. The public is thus expected by politicians to take responsibility for actions towards the reduction of climate impact. Since this demands a high level of understanding, both researchers and politicians point out the demand for an uncompromised and scientifically validated public communication on this complex issue. There is an evident need to find ways of communicating the scientific basis of climate change, its global implications and relevant action strategies to a variety of public audiences. Several types of science communication have been developed in different parts of the world to engage the public in climate-related issues and to explain the scientific basis of climate change. A development and evaluation of these types of science communication becomes particularly important when communicating action alternatives and life-style related issues to different audiences.

This paper will focus on an ongoing development project applying state-of-the-art computer graphics and visualization techniques to communicate climate science and policy research. The climate visualization program is presented in a full-dome theatre, with space for 100 visitors, based partly on an interactive geospatial visualization software and partly on 3D animation or video sequences. The program is aimed towards different audiences ranging from students in junior high school to a mixed audience attending the open general program in their spare time.

The objective of this paper is to critically analyze the potentials and challenges of climate communication through interactive dome visualization. Based on our earlier studies and a literature review of studies of public understanding of climate change and climate communication, we have identified two main focus areas, which we consider relevant when designing and implementing a visualization program for dome environments.

The first focus area concerns how we can tailor the visualization program to different target groups. We will discuss the role of narratives and how these need to be adapted to different audiences, as well as how the method of cognitive mapping could be used to investigate the audience's representations of climate change prior to the visit in the dome theatre.

Second, we will develop our ideas of how to engage the public and stimulate climate-friendly lifestyles through the visualization program. Much research has shown that when it comes to environmental issues, there is often a gap between people's attitudes and their behavior, and increased knowledge about climate change may not always lead to a change of lifestyles. Earlier studies have pointed to the importance of placing the abstract issue of climate change in a concrete context which engages audiences on a personal level. Hence, the visualization project will identify narratives that may combine global causes and effects of climate change with local impacts and action strategies. We will also discuss how climate visualization programs could benefit from interaction between scientists and the public during dome presentations.

54. Decision Modeling in Science Communication

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Abstract. Science communication professionals make decisions based on their experiences, their knowledge of best practices, implicit theoretical knowledge, comments of their peers, creativity and inspiration. Using decision support systems (DSS) aligns all those variables or sources and increases the quality and efficiency of the decisions made on science communication policies and strategies. We developed, and partly tested, in practice two preliminary DSSs: a decision aid for health communication professionals and a DSS to assess the evaluability of science communication projects. These DSSs have structuring and designing properties, but function also as a platform to bridge science communication practice and theory.

One of the main issues in communication in general and science communication in particular is to deal with uncertainties in the science communication process and outcomes. If a science communication professional can assess these uncertainties at forehand, expectations of commissioners and stakeholders could be managed more efficiently. To assess this kind of uncertainty, DSSs we have developed form the very beginning of science communication process simulation. This kind of simulation makes various possible outcomes of the science communication process tangible for science communication professionals. For example, we theoretically designed science communication process simulation for the implementation of smart energy grids in the city of London from a consumer behaviour perspective.

In the paper we will present our first results on DSS and modeling. Our results are a platform, as we see it, for developing a profound bridge between theory and practice of science communication. This bridge finally enhances both science communication practice and theory in real time and in a tangible way.

55. Study on the Relationship between School Students' Creative Imagination and Family Education Environment in China

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Abstract. Family environment, which was considered as the first individual living conditions and education environment, has strong influence on individual creative thinking. Using creative imagination test and questionnaire, with 116 school students aged from 6-19, this study explored the relationship between students' creative imagination and their family educational environment of Yichun forest area in China.

The findings of this study are:(1) Parents' education Background has influence on students' creative imagination, students whose parents' highest level of education were "elementary graduate illiterate" or "almost illiterate" scored lowest, (2) The creative imagination scores of students whose parents explain their inquiry with great patient are higher, (3) The creative imagination scores of students whose parents encourage them "hands-on" behavior are higher, (4) Communicating scientific knowledge frequently in family is helpful for students' creative imagination.

56. Formal and Informal Learning on Socioscientific Issues: **What Science Education Research Says to the Science Communicator**

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Abstract. The boundaries between science education and communication are blurring; learning science takes place in schools as well as in informal environments. What can science communicators learn from science education research when it comes to dealing with socioscientific issues (SSI), e.g. whether or not to have a genetic test in the genomics era?

In Utrecht University a project is running on genomics education and communication for citizenship. This is a project of the Cancer Genomics Centre and the Centre for Society and Genomics, funded by the Netherlands Genomics Initiative and based the Freudenthal Institute for Science and Mathematics Education. The project aims at embedding genomics in science education in terms of curriculum documents and in-service education of teachers. Simultaneously patient organisations and genomics researchers are being empowered for dialoguing on the cancer genomics research agenda and related socioscientific issues. Empowering focuses on conceptual understanding, clarifying the values and moral principles at stake and on raising awareness of different knowledge modes and how these interact.

In the last decade socioscientific issues are getting growing attention from science education researchers, e.g. the role of moral reasoning and discourse in science education. Ethical debate put high demands on teacher competencies and this issue is being addressed as well: how to support decision-making processes and how to balance facts and values.

Currently a review study is being carried out, which will be complemented by an international invitational expert workshop. Both educational researchers and practitioners will be invited to discuss the review study and formulate design criteria, which will be fed into our education and communication (research) activities. Two years ago a similar workshop, entitled ‘Rethinking science curricula in the genomics era’ was held (see http://bit.ly/bgqtAz). This paper will report the review study and the preliminary results of the invitational workshop with special attention to the implications of science education research on SSI for science communication in informal settings.

57. A Comparative Study on Coverage of Climate Change in National and Regional Newspapers

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Abstract. Climate change is the most important global environmental issue facing humanityin recent times. For developing countries like India the concern with climate change is extremely serious. The impact of climate change can be arrested and mitigated effectively on educating the people and increasing public awareness. Improved understanding of public perceptions about Global Warming can contribute to inform scientific and policy discussions of climate change. Newspapers play very significant role in educating, persuading and even in decision making of people on climate change. The scientific information on climate change provides logical thinking and makes people known about climate change and its dangerous impact on the earth. The reasoning ability thus developed can enable them with greater say in judicious use of resources, energy, reduction of GHGs emission etc. The present study was conducted to compare and analyze the coverage of climate change in national and regional news papers during the COP-15 held in last year and found that adequate information was disseminated. The study aims to bring out role of national and regional news papers in achieving the above stated objectives.

Keywords: Climate change news, Feature, Editorial, Dissemination of information, Educating people

58. Public Engagement on Environment and Government: A Case Study of National Consultations on Bt Brinjal and NMGI in India

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Abstract. Proactive public participation in government programmes at local, state, national and international level is the cornerstone of any successful democratic system today. This assumes even more significance when the communication between the governments and the public on matters related to public health, environment, agriculture, food and nutrition. That public consultation were held, before a decision whether to introduce Bt Brinjal in India or not was taken, is itself shows that the governments in less developed country like India are beginning to understand the importance of public participation in policy making on matters related to science and technology.

The Centre for Environment Education (CEE) conducted national consultations on Bt Brinjal on behalf of Ministry of Environment and Forests (MoEF), Government of India with an objective to consult multiple local stakeholders, belonging to distinct groups, for forward dialogue on Bt Brinjal. Another important objective of these consultations was to compile and collate the discussion held during these consultations in the final report. The final report of February 2010 captured the views of various stakeholders in the process and listed 544 concerns, out of which 93 were in favour, while the majority 451 concerns were against introduction of Bt Brinjal for cultivation in India. The consultation process should have provided a space for discussions and networking across the board for the multiple stakeholders in Bt Brinjal; and should have provided space for discussion among the smaller and lesser voiced debates. It should also have opened a dialogue on the Bt. Brinjal. But after a decision not to allow Bt Brinjal was made by the MoEF favouring the majority concerns raised during consultations.

With nearly 6000 registered participants for the seven consultations, and more than 9000 written submissions, some of them of book length, were presented to MoEF, in very little time for consultations (about 25 hours in total, averaging a little more than 3 hours for each location. From what was collected, MoEF generated a bibliography with over 450 entries. If one of the purpose of these consultations was to get stakeholders' feedback and representations on Bt Brinjal, then an appropriate feedback mechanism could have been established where stakeholders could provide feedback to government on the issue before, on and after the scheduled date(s) for consultations. But, the time available to stakeholders was too short for them to prepare accordingly.

There has almost been no communication between the (public) stakeholders, and the scientific community and the government after the consultations were over and once a decision was taken, though there have been many developments related to the subject. Besides there have been other public consultations.

This paper analyses the process of public consultations on Bt Brinjal and on National Mission for a Green India (NMGI) carried out this year with their objectives and outcomes. There seems to have been little learning in the way such public exercises should be conducted. The total number of participants in consultations on NMGI reduced to less than a quarter than in those for Bt Brinjal, although the general scope of NMGI is much wider and would affect the lives and livelihood of greater number of people than those by Bt Brinjal.

This paper puts forward a few suggestions for the government, scientific community, media, and the stakeholders to make such public consultations on matters related to science and technology in general, and environment in particular, more effective and inclusive so that many individuals, groups, sections and communities not covered by previous consultations could be reached, and there is substantial outcome in the form of mechanisms (permanent or quasi-permanent) and institutions that sustain public engagement with governments.

59. Social Agency, Justice and Transformation in the Quest For a **Globally Representative Communication of Science**

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Abstract. The communication methods and educational systems that are applied to report scientific findings and technological advances to the public have come under repeated critical scrutiny during the past few years. This communication process, often overlooks deep seated philosophical and epistemological differences between cultures and continents. One prominent area of neglect is the failure to incorporate the specific knowledge(s) of traditional communities into mainstream epistemological discourse. Traditional knowledge has historically been restricted as 'discoveries' by outsider researchers. The traditional epistemic status of traditional communities, as a direct result, remains to be considered as incompatible with the 'scientific' and 'progressive' nature of modern western knowledge. Modern science and technology, therefore, is deemed to operate above (and beyond) the more 'primitive' processes of traditional scientific methods. Modern science is only prepared to acknowledge the 'primitive' methods of traditional knowledge systems in so far as the latter serves as confirmation of the formers' alleged superior cognitive status. It is from this so-called superior perspective that modernity will allow itself to speak of 'traditional agricultural methods', 'traditional water harvesting methods' or even 'traditional craft production methods'.

In this paper I will argue against this artificial barrier in the communication of science. Considering science principles as universal, and acknowledging the historical role that philosophers play in contextualising science knowledge, I will present some options to guide the re-alignment of global science communication towards becoming a more inclusive activity between the industrialised and developing worlds by asking fundamental philosophical questions about social justice, agency and the possibility of change. My focus will be on Africa and India. I will mention, in specific, the work of western philosophers such as Jürgen Habermas (1981. 1987, 1994) and Richard Rorty (1980) and African Philosophers such as Paulin Hountondji (1997, 2002) and Kwasi Wiredu (1975, 2000). Their opinions will be juxtaposed against ideas that developed in India as explored by Amarthya Sen (2000).

Keywords: western science, traditional science, epistemology and philosophy.

Introduction

In the wake of a near absence in communicating science to the public in Africa, the discipline of African philosophy took as task the topic of science communication to explore the philosophical relation with science in general and with traditional societies in specific. The development of African philosophy, as a result, is closely associated with the advancement of science and technology. This relationship is not unique. It is similar to the development of European philosophy when philosophy-as-epistemology affiliated strongly with the Enlightenment 'idea of progress'.

During the European Enlightenment science became the 'subject' and scientific method was recognised as the measure for progress. This centrality of philosophy-as-epistemology in the 'project of modernity' and its inability to overcome the reliance on a subject-centred epistemological paradigm, is intensely debated by western philosophers such as Jürgen Habermas (1981; 1987; 1994). Habermas initially strived to reconstruct the genealogy of the modern natural and human sciences by inquiring about the details of their social, historical and epistemological conditions of emergence. He later adopted a perspective based on a theory of 'communicative action' derived from speech- act philosophy, socio-linguistics and ideas about conversational implicature (Honderich, 1995:330). Central to the work of Habermas is, however, the effort to combine specialist philosophical interests with an active commitment to promoting informed discussion on issues of urgent public concern (Honderich, 1995:330). Habermas (1981), in this regard, is a promoter of effective science communication.

The modern-day 'lack of independence' of philosophy (from science progress) has also been dramatically challenged by western philosophers such as Richard Rorty (1980. 1982). Central to Rorty's (1980) challenge is the deconstruction of the ontological assumption of (western) man as the privileged seat and centre of human rationality.

The notion that epistemology can exist as a discipline capable of justifying and validating scientific knowledge claims, is rejected by Rorty (1980). It follows that philosophy is incapable of providing a neutral universal framework that can be assumed (adopted) to precede, justify and validate the foundational scientific form of knowledge. A significant consequence of Rorty's rejection of this epistemological foundationalism is his rejection of a correspondence theory of truth, deemed capable of describing reality 'as it is'. In the place of an objectivist approach to reality as a project of epistemology in the service of science, Rorty (1980:315) encourages his reader to accept the possibility of an epistemological vacuum that naturally follows the demise of the modern epistemological tradition.

Rorty's (1980) arguments against epistemological foundationalism are important in so far as it encourages a re-conceptualization of modernity's central universalistic claims with regard to truth, objectivity and rationality. For as long as nature (the universe) is assumed to be absolutely (ontologically) of humankind, the scientific enterprise will likewise be conceptualized as a discipline that transcends the more parochial interests and passions of the non-scientific thinker.

The importance of this argument for us is Rorty's (1991:166) promotion of a ruthless scepticism about philosophy's self-definition and epistemological 'task' in the defining of science. He criticizes the limitations of philosophy-as-epistemology to recognise appropriate scientific (including traditional) knowledge since science in its current form provides humanity with a basic 'ticking list' of observations which too often lacks deeper probing and rules out further reflection. Sandra Harding (1997:49) maintains that 'modern science' re-inscribes the dichotomy between the dynamic, progressive sciences of the west and the static unchanging traditional knowledge of other cultures. According to Harding (1997) this condition generates the benefits of modern science to be disproportionably distributed to western elites and she claims that: "… whether sciences intended to improve the military, agriculture, manufacturing, health or even the environment, the expanded opportunities that science makes possible have been distributed predominantly to already privileged people of European descent, at the cost to the already poorest, racial and ethnic minorities, women and Third World peoples" (Harding, 1997:55).

According to Rorty (1980), philosophy should abandon efforts to consider reality through some a priori conceptual framework (which we ourselves have put into existence). In addition, philosophy should abandon efforts to claim a universal context for the validation claim of scientific knowledge. Such a post-epistemological approach will render the need for a transcendental foundational discipline obsolete. The real work of science must be done by the scientists, and the philosopher must resist the temptation "… to jack up [the achievements of science] a few levels of abstraction, invent a metaphysical or epistemological or semantic vocabulary into which to translate it, and announce that he has grounded it" (Rorty, 1991:168).

In the place of the modern epistemological legacy of foundationalism, Rorty (1980:315) proposes a hermeneutic approach to rationality and truth in the objective world. According to Honderich (1995:353), hermeneutics refer to "… the inherent circularity of all understanding, or the fact that comprehension can only come about through a tacit foreknowledge that alerts us to salient features of the text which would otherwise escape notice". Bernstein (1983:38) points out that, according to the interpretation of texts, the earlier traditions of hermeneutics distinguished three elements:"… subtilitas intelligendi (understanding), subtilitas explicandi (interpretation) and subtilitas applicandi (application)". Heidegger (1977) and Gadamer (1975) extended the application of hermeneutics, initially focussed on the interpretation of text, to the interpretation of technology. Gadamer (1975), for example, proposes that the three features of hermeneutics–understanding, interpretation and application–do not happen successively and functions collaboratively. He focuses on the relation between 'practical knowledge' and 'theoretical/technical knowledge' and considers hermeneutics to be the heir of practical philosophy which, in turn, bring concepts such as 'scientific method' (in the sciences) and historico-critical method (in the human sciences) into question (Gadamer, 1975:342).

According to Rorty, hermeneutics relieves us of the need to justify scientific knowledge claims from a universal perspective. He argues furthermore that the hermeneutic principle of justification of our social principles is sufficient ground for our acceptance of the notion of truth in a pragmatic sense. For Rorty the hermeneutic approach therefore cynically presents "… an expression of hope that the cultural space left by the demise of epistemology will not be filled" (Rorty, 1980:315).

Rorty's (1980) critique of the modern epistemological condition and his philosophical announcement of a post-modern ethos characterized by contingency and pluralism, (in short, an ethos epistemologically devoid of all claims and pretensions to universalism) opens up the possibility and the need to explore other non-western forms of knowledge and rationality. By accepting the ethno-cultural horizons governing one's place in history as the point of departure, Rorty (1980) therefore encourages a more conversational approach to the question of knowledge "… with the notion of truth being associated with the best idea we currently have to explain what is going on" (Rorty 1980:320).

African philosophy in service of science

With the European enlightenment promoting scientific innovations, the 'idea of progress', it was argued, became the measure of modernism in the west. On the other hand, 'colonialism' became the African measure and indicator of scientific progress. It can be argued that colonialisation in Africa marginalised traditional scientific knowledge and traditional practices as rapidly as modern industrial and economic development expanded in the west. Underpinning the idea that all men are the same, the awareness grew that cultures differ and live in different geographical worlds requiring different social strategies for survival. For western science, in the quest to study man, 'race' soon became the marker for different social practices that constitute different cultures. Race therefore became a science 'subject' and racial differences became a cultural 'marker'. The paradoxical result of celebrating differences, respect for pluralism and acknowledgment of identity politics – which became the feature of a liberal-modern democratic outlook – made science a political issue since the science of human differences could only be read in a racial fashion (Malik, 2008). This can be referred to as the 'guilt of science'.

Opinions about the intensity of this marginalisation process vary. Kwasi Wiredu (2000:175), for example, does not consider modernism to be "… bad in and of itself, but [consists of] ill-conceived programs of implementing modernization [that] have been harmful to African societies". Wiredu (1975:320), in addition, implores us to distinguish, in the African context, between traditional – that is pre-scientific spiritualistic thought – and modern scientific theory.

If we consider that epistemology functions in the total context of the human 'right to life' in traditional societies, we need to recognise the universality of these actions. Wiredu (1975), in a sense, blames the west for looking at traditional African epistemology in a highly selectively manner, thereby overlooking the very specific, non-scientific characteristics that typify African traditional thought in general. The west tends to define this specific non-scientific characteristic as a way of thought to be peculiarly African, instead of looking at it in a broader context and acknowledging its striking similarities to western epistemology.

Kwame Gyekye (1997) is less critical about the west's duplicity in the even distribution of modern science and advocates acceptance of western modernity by Africa. According to Gyekye (1997:30), 'modernity' is to be considered an ideal measure of progress. 'Traditional' should be seen as something that should aspire to this ideal of progress by embracing the theoretical development of science that requires sustained scientific probing since "… the impulse for sustained scientific or intellectual probing does not appear to have been nurtured and promoted by our traditional cultures". The African philosopher Kwame Appiah (1992), in contribution to this debate, initiated intense and widespread discussions in Africa on the relationship between race and culture and the differences between indigenous and global knowledge systems. He became overtly concerned with efforts to define the course and causes of development in relation to the growth of science.

Emmanuel Eze (1997:12), who persuasively postulated that the philosophical notion of 'reason' was popularised at the beginning of modern (western) philosophy by Descartes, furthers the argument around indigenous and global knowledge systems by claiming that "… the nature of human rationality seems to require that the best way to define reason philosophically is by demonstration. The demonstration will require amassing empirical or scientific evidence for the rational, and reflecting on this concept of evidentiality". Eze (1997) considers duplicity to be at the heart of modernity whereby modernity, in its subscription to ideals of humanity and democracy, condones the colonial subjugation and marginalization of non-western people by indicating the perceived difference between the rhetoric of the west and the 'lived reality' in Africa.

Based on the contributions by African philosophers, the relationship between philosophy and the sciences is quite pronounced in Africa. Paulin Hountondji (1976:99) in this regard proposes the hypothesis that "… the first precondition for a history of philosophy, the first precondition for philosophy as history, is therefore the existence of a scientific practice, the existence of science as organised material practice reflected in discourse. But one must go back even further: the chief requirement of science itself is writing. It is difficult to imagine a scientific civilisation that is not a civilization based on writing, difficult to imagine a scientific tradition in society in which knowledge can be transmitted orally. Therefore African civilizations could not give birth to any science, in the strictest sense of the word, until they had undergone the profound transformation through which we see them going today, that transformation which is gradually changing them, from within, into literate civilizations".

Ivan Karp (2000:4) appropriately observes that it is clear that African philosophers are divided into two camps; those who believe that technical and academic philosophy provides the tools for a much needed critique and revision of traditional African thought and those who argue that the critical skills and attitudes of western philosophers can also be found in African cultures. However, both these positions have roots in academic and social movements originating from the west. What is lacking is the centralisation of this debate within a non-western context.

Moving Towards Individual Agency, Abstract Theory and Openness– Examples From India

African philosophers realised that they are not alone in feeling marginalized from mainstream science and from being considered within the proviso of being ‘underdeveloped’ and ‘unscientific’. Parallel problems are identified by, for example, the Subaltern group in India whose members argue that the specificity of the subaltern voice (by implication their epistemological contribution) has been systematically erased by both colonial and nationalist historians. The term ‘subaltern’ is used to group together the section of society who faces oppression (Morton, 2003). The Italian Marxist, Antonio Gramsci (1881–1937), used ‘subaltern’ to refer to a person or group of inferior rank or status caused by race, class, gender, sexual orientation, ethnicity or religion. He considered subaltern groups to be, by definition, subjected to the authority of ruling groups even when they rose up in rebellion. His definition of the subaltern was adopted by Gayatri Spivak (1998; 1988) and others because it easily provides a key theoretical resource for understanding the condition of the poor, the lower class and peasantry in India. The parallels drawn by Gramsci between the division of labour in Mussolini’s Italy and the colonial division of labour in India, made this possible.

In both India and Africa there is a drive for recognition and respect for the complexities of the motives and cultures of these subaltern agents. This includes, as Karp (2000:3) suggests, respect for “… the complicit role of the intellectual in the power politics and crises of the postcolonial state; the role of criticism in the politics of knowledge; and the conflicts among cosmopolitan, nationalist and indigenous forms of knowledge. Intellectual historians and sociologists of knowledge will have to work out the reasons why parallel critiques have developed in such different disciplinary locations and discursive spaces in Africa and India, and they will also have to work out the differences as well as similarities in the ways in which postcolonial criticism emerges as a formation in two such different geographical and cultural locations”.

In India, Amartya Sen (2000) aptly considered these issues mentioned above and, in addition, emphasised the role women can play in bringing about social change through agency and as free agents of change. Sen (2000) discussed in some detail the approach to gender differentiation from studies conducted by Jean Drèze and Mamta Murthi in India in 1999. When considering the high rate of female and child mortality in male dominant societies, causal relations to development were probed in variables, positioning low survival prospects against areas of possible agency: female literacy rates, female labour force participation, incidence of poverty, levels of income, extent of urbanisation, availability of medical facilities and the proportion of socially underprivileged groups (caste) (Sen, 2000).

Two aspects regarding the promotion of literacy in India became clear in the surveys conducted by Drèze and Murthi (1999). In the first place gainful employment produced ambiguous outcomes: responsibilities for household work became an added burden. In the second place, becoming more literate statistically showed a significant reduction of under-five mortality. Finally “… the impact of greater empowerment and agency role of women is not reduced in effectiveness by problems arising from inflexible male participation in child care and household work’ (Sen, 2000:197).

Dual Worlds, Multiple Problems– Solutions Through Agency

By looking at hermeneutics, as proposed by Rorty (1980), we are provided with an option to experience some measure of relief from a need to justify scientific knowledge claims from a universal perspective. When we apply the Rortian hermeneutic principle as aid in the justification of our social principles, we might find sufficient ground for change. What these changes should aim to be, however, is difficult to establish. If we liberate the debate from the social movement of post-colonialism we create a ‘freezone’ where new perspectives on developmental issues can become intertwined with debates on ‘scientific validity’ and ‘scientific literacy’ – both prominent issues in science communication debates and the research focussed on by the Public Understanding of Science (PUS). This, however, is no easy task and comes with its own particular and spectacular problems. Aijaz Ahmad (1992:315), for instance, persuasively speculates about a world devoid of differentiated structures and the disappearance of the so-called ‘three worlds’. In the problematic issue of merging the world economies, he mentions the subordinated partnership of developing countries with imperial capital as a debilitating factor. He proposes that “… most of the Asian zones simply cannot ever hope to develop stable societies, and the devastating combination of the most modern technology and backward capitalist development is likely to inflict upon these societies, on lands and peoples alike, kinds of degrees of destruction unimaginable even during the colonial period”.

The most appropriate option I can think of is to turn–yet again–to the philosophers for redemption. How will they advise science communicators to effectively promote science communication against such a diverse and complex background? Three scenarios are possible:

1. The redemption of traditional knowledge systems (IKS). It is now acknowledged that some aspects of African thought are collective and unchanging. To emancipate IKS both Wiredu (1980) and Hountondji (1983) valorise the individual as the agent of change through social and cultural criticism. Both use the colonial and postcolonial as spatial and temporal realities and both require the application of individual agency, abstract theory and openness. More specifically, Wiredu (1980) proposes analytical practice in the quest to solve failed past methods and solutions. Hountondji (1983) proposes the Althusserian neo-Marxist notions with its specifying evolving relationships among power, ideology and a constantly changing social world (Karp, 2000:8).
2. Emancipatory social justice through agency. Agency refers to a person being the 'subject of action', who posses the capacity to choose between options and then, ultimately, to be able to do what one chooses. Agency is treated as a causal power (Honderich, 1995:18). In patriarchal societies such as Africa and India, social justice involves more than 'being free to choose'. Social justice means active participation in education. In this regard Marion Young (1990:173) states that: "… a goal of social justice, I will assume, is social equality. Equality refers not primarily to the distribution of social goods, though distributions are certainly entailed by social equality. It refers primarily to the full participation and inclusion of everyone in society's major institutions, and the socially supported substantive opportunity for all to develop and exercise their capacities and realise their choices". Chandra Mohanty (2003:205) adds to this by stating: "Pedagogy needs to be revolutionary to combat business as usual in educational institutions … revolutionary pedagogy needs to lead to a consciousness of injustice".
3. Critically analyse aspects of modernity and tradition in order to promote individual and social agency in the developing worlds. Challenging the concept of western modernism is inevitably linked with the embracement of western capitalism and western scientific rationality. Africa embraced western capitalism but scientific rationality became an ambivalent site of dispute through the polarisation of tradition and modernity. One of the prominent philosophers who challenge Africa to become independent (and literate) in order to participate in the global science debate is Hountondji (2002) who critically recalls comments on the history of integration and subordination of African traditional knowledge to the world system of knowledge. Hountondji, (2002: 501) identifies a number of what he calls 'scientific extroversions' (Africa being forced to integrate into the world market of concepts) which indicates that "… a need to secure an audience or readership, a legitimate need, often leads Southern scholars to a type of mental extroversion. They are pre-orientated in choosing their research topics and methods by the expectations of their potential public which then causes them to lock themselves up into an empirical description of the most peculiar features of their societies, without any consistent effort to interpret, elaborate on, or theorize about these features. In so doing, they implicitly agree to act as informants, though learned informants, for western science and scientists" (Hountondji, 2002: 503).

Conclusion

The list of actions that are required towards achieving social justice in the developing worlds is much more comprehensive and much more complex than the few points I was able to highlight during this presentation. I also hope to further the debate on the complex issues related to the main objective of this conference from a developing world context. As indicated by the organisers of this conference, the economic and social wellbeing of society promotes participatory democracy and implies the ability to respond to technical issues and problems that pervade our daily lives. This, by implication, requires a serious deliberation about the status and relation between modernity and tradition. The perceived gap between modernity and tradition, in facilitation of a better science communication, can only be addressed by a thorough understanding of social justice, the promotion of agency on all levels and collectively amongst all members of society, creating a deliberate possibility of change.

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60. Science Communication Professional Profiles as a Starting Point to Develop Science Communication Curricula

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Abstract. In the last decade the number of science communication training programs has increased worldwide. There are many differences between the programs, as was concluded in the PCST 2008 workshop on science communication curricula and in our analysis of 20 university programs. This analysis (based on information on the internet and interviews) showed that the focus of many of the programs is not very clear, nor is the way the particular programs relate to the students' future professions.

An overview of science communication professional profiles would clarify the various tasks of the professionals and be a starting point to develop educational programs. As far as we know such an overview of professional profiles is lacking. One of the aims of our research at Delft University of Technology is to design a model of science communication professional profiles that may be used worldwide as a basis to draw up science communication curricula and to stress the distinctive features of the programs. The model can be the starting point to formulate competence profiles aimed at recruitment and selection of SC professionals and to create routes for professional development (refresher courses / post-graduate courses). The model we designed (version 1.0) has been derived from a model for the communication domain that was recently developed by educational experts and experts from the communication practice, commissioned by the Dutch Association of Communication professionals Logeion. This model consists of six key tasks / activities communication professionals perform: to analyze, to advise, to create, to organize, to guide and to manage communication processes. Each of these activities is described on six levels. The responsibilities and complexity of the described activities increase from one level to the next. For each of the 36 cells in the matrix it was made explicit 1) which actions a communication professional performs, 2) what could be the output of the act, 3) what a professional has to know in order to perform the task and 4) what kind of skills (s)he needs to have. For each professional a profile can be created: a combination of activities on the same or on different levels.

Based on a workshop with science communication professionals, a survey of professionals and a workshop with science communication educators in The Netherlands we came up with a first version of the model developed for the Science communication domain. During the PCST 2010 conference we will present and explain the model and discuss its content and feasibility. We will focus on the profiles and the way they can be used to develop science communication curricula.

61. A Research on the Methodology of Contents Planning for Science Exhibition as a Way of Science Communication

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Abstract. Science exhibition is one of ways of science communication. Therefore, basic function of science exhibition is to transmit science communication well. Science communication paradigm has moved on from one-way communication called deficit model to two-way communication based on contextual model, and this paradigm shift changed a lot of things, like objectives, public engagement, and messages of science communication. But some science exhibitions in Korea don't recognize this paradigm shift, especially paradigm shift of contents. So, this study focused on this contents paradigm which was expanded from fact-transmission to meaning-transmission, and proposed the methodology of science contents planning in order to transmit the two-way science communication.

To suggest this methodology, literature survey and exhibition analysis was carried out. Through analyzing the expanded objectives of science communication, 7 criteria of methodology were set up: awareness(A), enjoyment(E), interest(I), opinion(O), theory-understanding(TU), process-understanding(PU), social impacts-understanding(SU). And by using the storyline process, the method to extract the message from exhibition analysis was developed. With 7 criteria and the message-extraction method were used to analyze exhibitions in 3 science museums.

As a result, various meaning factors of the message according to the objectives of science communication were found. And through these results, the methodology of contents planning for the expanded objectives of science communication was suggested.

This methodology will be used for curators as an idea bank and the manual of science exhibition contents planning and provide the logical framework in science exhibition planning based on science communication. And it will be used as a basic material for future science exhibition planning.

62. The Impact of Training on Scientists' View of, and Skills in **Science Communication**

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Abstract. For most adults in the developed world the media is the primary source of information about science. However, there is a general unrest regarding the quantity and quality of science coverage in the media. Possible sources of this discontent are the media, the public and the scientists themselves. Public knowledge and attitudes have been widely assessed, and many studies have examined media coverage of science. However, few studies have systematically examined the capabilities and other aspects of scientists' ability to communicate. Nonetheless, many organizations and institutions have created training opportunities to help scientists become better at public communication.

The claims for the efficiency of such training programs are often based on anecdotes and basic self-report evaluations. This situation does not allow comparison between interventions, nor evidence-based policy regarding media training for scientists. This study sets out to examine the learning outcomes of science communication training programs and courses. Learning outcomes may include skills, confidence, willingness to take part, attitude towards interacting and public engagement, and knowledge of science-media context (dependent variables). Some of the independent variables involved in scientists' views and skills are assumed to be training, age, gender, field of science, years since final degree, previous experience with outreach, position, and type of institution/employer.

The development of a measurement tool for scientists' views of, and actual skills in science communication was guided by existing literature, extensive interviews with active scientists in order to establish face validity, as well as establishment of test/retest reliability. The instrument, which is intended to serve at a wide range of training workshops and courses, includes three sections:

(1) Professional background, experience with public engagement, and specifically with the media.

(2) Written skills, which are assessed based on three short essays: describing one's research, responding to a question about science in everyday life (e.g. "Why doesn't the doctor prescribe antibiotics for flu?"), and to a question about science's role in society (e.g. "Are humans responsible for the Earth getting warmer or not?"). Responders are also presented with a list of science concepts and are asked to mark those that should be defined when writing to a non-technical audience.

(3) Views section, which includes self confidence in speaking with the media, attitudes towards the science in the media (e.g. importance, level of coverage), the responsibility of the individual scientists, benefits and impediments to speaking to the media, attitudes towards public engagement with science policy, and finally, knowledge about the media and public understanding of science.

Preliminary findings from a "Science writing for the media" course will be presented at the talk. Later on, this measurement tool will enable the assessment of learning outcomes from media training to scientists, which will allow highlighting effective initiatives. It will also be used to compare groups of scientists from different countries or disciplines. Finally, it will allow an exploration of the interactions among the independent and dependent variables.

63. Update on Communicating Science to the Public through the Performing Arts

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Abstract. Update on Communicating Science to the Public through the Performing Arts Brian Schwartz The Graduate Center and Brooklyn College of the City University of New York bschwartz@gc.cuny.edu In this paper, we report on a very recent international conference at the Graduate Center of the City University of New York. The conference, held on October 29 and 30, 2010 was focused on the Communication of Science to the Public through the Performing Arts. See http://www.sciartconference2010.com/ The conference is based on over 10 years of experience in communicating science to the public through the arts at the Graduate Center under the program Science & the Arts. Each year for the past 10 years, approximately 10 Science & the Arts events were presented. Some programs were one-time events while others, such as the ones related to the play Copenhagen; the celebration of the International Year of Physics in 2005; and the programs associated with the performance of the opera Doctor Atomic by the Metropolitan Opera, were a curated series of performances, presentations and seminars. The conference has invited sessions on the following themes: (1) Science and Theatre; (2) Science and Dance; (3) Science and Music; (4) Science and Films, TV and Radio and (5) Science Festivals and Science Cafes.

The speakers and moderators at the conference include: Frank Burnet, Science Festivals: Cheltenham Science Festival and Other European Festival, http://frankburnet.com/about; Liliane Campos, Theatre: Literary Analysis of Science Plays, http://www.texte-et-critique-du-texte.paris-sorbonne.fr/annuaire/liliane_campos.htm; Jerry Carlson, Film: Film Criticism, http://cuny.tv/series/citycine/carlson.lasso; Marvin Carlson, Theatre: Literary Criticism, http:// web.gc.cuny.edu/theatre/faculty/index.html; Marco Cavaglià, Science Exhibits: Laser Interferometer Gravitational- wave Observatory (LIGO), http://www.aps.org/units/fed/newsletters/spring2010/cavaglia.cfm and http://www.ligo. caltech.edu/; Robert Clyman, Theatre: Science and Theatre from the Viewpoint of the Playwright, http://www.doollee. com/PlaywrightsC/clyman-robert.html; Dorian Devins, Science Cafes and Outreach: The Secret Science Club http:// secretscienceclub.blogspot.com/ and http://www.mnn.com/green-tech/research-innovations/stories/the-secret-science-club; John Durant, Science Festivals: Science Festivals in the US and Support by NSF Informal Science Program http:// web.mit.edu/sts/people/durant.html; Stuart Firestein, Theatre: Scientist and Critic http://www.sciencemag.org/cgi/ content/full/327/5962/146-a and http://www.columbia.edu/cu/biology/faculty-data/stuart-firestein/faculty.html; Alexis Gambis, Film: Imagine Science Film Festival, http://www.imaginesciencefilms.com/about/; Graeme Gillis, Theatre: Ensemble Studio Theatre / Alfred P. Sloan Foundation Science & Technology Project, http://ensemblestudiotheatre. org/programs/estsloan-project/; Arthur Giron, Theatre: Science and Theatre from the Viewpoint of the Playwright http://www.doollee.com/PlaywrightsG/giron-arthur.html; Ira Hauptman; Theatre: Science and Theatre from the Viewpoint of the Playwright, http://www.playscripts.com/author.php3?authorid=408 and http://www.doollee.com/ PlaywrightsH/hauptman-ira.html; Roald Hoffmann; Science Cafes: Ten Years at the Cornelia Street Café, http://www. roaldhoffmann.com; Brian W. Holmes. Music: Understanding Musical Instruments: Composing "Updike's Science" http://www.thorpemusic.com/holmes02.html and http://www.classical-composers.org/comp/holmes_brian; Ken Laws: Dance: The Physics of Dance, http://physics.dickinson.edu:16080/~pod_web/; Jodi Lomask, Dance: Capacitor Dance Company, http://www.capacitor.org; Cassandra Medley, Theatre: Science and Theatre from the Viewpoint of the Playwright, http://www.doollee.com/PlaywrightsM/medley-cassandra.html; Ann G. Merchant, Film and TV: The Role of Science & Entertainment Exchange http://www.scienceandentertainmentexchange.org; Odd tOdd, Animation: Science Communication via Science Toons, http://www.oddtoddstudios.com; Sidney Perkowitz Film: Author: Hollywood Science: Movies, Science and the End of the World, http://www.sidneyperkowitz.net; Nancy Rhodes, Music: A New Science Opera: The Theory of Everything, http://www.encompassopera.org; David P. Saltzberg; TV: Physics and the Making of "The Big Bang" TV Comedy Series, http://personnel.physics.ucla.edu/directory/faculty/ index.php?f_name=saltzberg and http://www.symmetrymagazine.org/cms/?pid=1000595; Elizabeth Streb, Dance: STREB Lab for Action Mechanic (SLAM), http://www.streb.org/; Thomas Warfield, Dance: Science the Universal Language of Movement, http://www.ntid.rit.edu/media/full_text.php?article_id=849; Benjamin Wolff, Music: Galileo's Muse, http://galileosmuse.com/; Eva-Sabine Zehelein, Theatre: Literary Analysis of Science Plays, http:// www.uni-frankfurt.de/fb/fb10/ieas/abteilungen/amerikanistik/lehrende/zehelein/index.html; Samuel Zygmuntowicz, Music: The Making and Science of String Instruments http://artistled.com/Biographies/Samuel_Zygmuntowicz.htm

Keywords: Science and the Performing Arts, Theatre, Dance, Music, Film and Festivals

64. Accountability in Science Outreach: Aligning Impact Evaluation with Objectives in Science Outreach to Schools

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Abstract. It is impossible to maximize effectiveness if effectiveness is not firstly defined and secondly measured. Science, technology, engineering and mathematics (STEM) outreach programs have long basked in a reputation of assumed positive impact; programs are often touted with producing many benefits such as improving attitudes towards STEM fields, raising awareness and engagement in STEM careers, increasing enrolments in STEM subjects and generally reengaging students with STEM. However, much of the evidence of these impacts is anecdotal. Increasingly program providers are being asked to empirically demonstrate their program's effectiveness and impact, that is, they are being held accountable.

Empirically evaluating the impact of these programs is challenging. The issue of impact is multifaceted and it is difficult to account for all of the relevant variables. It is hard to obtain large sample and control groups and also to avoid self-selection of participants. Even knowing what impacts or outcomes to look for can be problematic.

With these challenges in mind, a research project was undertaken to map STEM school-based outreach programs across Australia in terms of their aims, reach, model and evaluation, while also conducting case study evaluations into the impact of two outreach programs. The research used a mixed methods design and included participants (n1,335) across questionnaires, focus groups, interviews and field observations.

This research highlighted a concerning misalignment between the stated objectives of many outreach programs and their evaluative measures of success. The most commonly cited program objectives were to 'inspire' or 'engage' students and to 'encourage the pursuit of science careers or studies'. However, the evaluation approach of many programs was limited to attendance numbers and informal feedback. Most of the programs detailed in the research cited obsequious objectives statements about intangible outcomes. None reported measurable program objectives that adequately outlined target audiences, intended outcomes or set parameters on these outcomes such as the direction of change, the extent or the timeframe.

There is a need for encouraging STEM outreach programs to adopt objectives-driven, evidence based decision making in program management. This managerial approach, if encouraged across the field, could improve program efficiency and effectiveness as well as provide programs, sponsors and participants with a greater level of program accountability for the resources utilised.

One approach to facilitate evaluation across a program management cycle is the development of an evaluation toolkit for common use among STEM outreach providers with the potential to be tailored to individual program needs. Taut & Alkin (2003) asked outreach program staff to identify the biggest logistical barriers to program evaluation; the most commonly cited barriers were a lack of time, budget and the expertise required to access the data. A common evaluation toolkit would not only drastically reduce the evaluation resource requirements of individual providers, it would encourage a more consistent evaluative measure across the field of STEM outreach. This in turn would allow meta-analyses into the impact of the globally expanding field of STEM outreach. It would also hold great marketing potential for individual providers specifically and the field of STEM outreach generally.

65. Looking into Theoretical Development of
Science Popularization Studies in China

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Abstract. Science popularization, or science communication, holds its ground as a favorable cultural device long since the coming out of new China, but it was not until 1980's that science popularization studies in China stepped into the stage of theoretical integration. This paper is intended to (1) briefly review the scenarios of science communication for the public in a span of 60 years in different cultural contexts, (2) trace down the developing path of science popularization studies at theoretical level by discussing deeply into the focusing issues occurring in the period of theoretical integration.

Since 1980's, the arena of science popularization was boiling with all kinds of arguments. The paper will look deep into the diversified pallet of theories and sayings in the field by concentrating on the most important ones. The main issues were divided into 3 themes: (1) theories of "science popularization" as a discipline, (2) reflections on "traditional science popularization" ideas and their transition and modification, (3) studies on "public scientific literacy".

After the National Science Convention in 1978, while studies on science writing kept receiving attention of some researchers, the attempt to build some kind of theoretical frame for science popularization studies came out and several experiments has been made. This is the first try to make understandings and cognitions of science popularization into a systematical structure based on which a special discipline was supposed to be created.

1990's saw the turning point of science popularization studies under the influences of the Western theories. "Science Communication" studies started from the approaches of communication science and PUS theories. Experts and researchers from universities began to question and criticize the traditional science popularization modes and ideas by pointing out that old notion of "science popularization" can no longer adapt to the new changes science communication requested. They thought science popularization had 3 stages: traditional stage, PUS stage, reflective science communication stage and put forward corresponding communication models and stands to the 3 stages. Their arguments brought transition and modification of old science popularization ideas.

From 21th century, research on "public scientific literacy" became the core subject of science popularization studies. The achievements of such researches were applied in the Surveys of Public Scientific Literacy and the formulation of the Outline of the National Scheme for Scientific Literacy. At the end of the paper, the characteristics of science popularization studies in China were summarized.

66. A Novel Web Based Effort for Sharing of Scientific Ideas and Results

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Abstract. This paper report the study of a web based online portal (www.thinkbiosoln.com) that provides green solutions to cater to small and middle level companies and promote solution based research towards promoting science. The website targets to harness the power of online portal to connect to prospective researchers, and promote them suitably towards developing products.

A complete study on promotion of said technology and there output in number of feasible solutions is shown in this paper. It is a novel model for future ventures to invest in science communication with a goal of resource building and promoting innovation and research.

Keywords: Innovation portal, Science Promotion, Entrepreneurship.

Background

Computer connected through internet and intranet as a platform for communication was presented and modelled much before the actual practice by Licklider et.al in 1968. [1]Though early developers in communication were positive about the possibilities, they feared that an online communication of ideas will be restricted due to lack of externalized modelling of the user's emotion and may hinder successful or competent transfer of relevant emotions which justifies the data. Other potential threat to such possibilities includes slow internet connections, interactive web spaces, and lack of high end graphics. [2-3]

Also the potentiality for scientific communications was shown by Robert Kraut to be majorly dependent on the distance between the scientific departments and the subject area of expertise. [4] The clauses for observation were elaborated as communication frequency, quality of communications and cost of communication. The equation monitoring communication frequency by distance between collaborators showed positive collaborative probabilities for near and relevant research fraternities.[5-7] However recent advances in communication speeds and the advent of interdisciplinary research in recent years have led to substantial changes in the proposed Equation (i) suggested by Kraut et.al.

$$y = 4.82+4.56 \times \text{distance} \times .459 \text{ [4]} \qquad \{i\}$$

Y. F. Le Coadic uses a mathematical approach for studying the propagation of scientific ideas and operation and structure of science and technology information systems. They have shown information system to be a dynamic and orderly social system which exhibits impressive features of regularity and law within deterministic limits. It has also been observed that by formalizing the informal channels, the overall effectiveness of communication can be further improved. They have shown the evolution with time of the number of researchers getting an idea in the selected disciplines and fields. [8-13]

As Thomas Goetz explores the possibilities of open science from operating system and softwares to wikis and online journals, it clearly shows that open sourcing of ideas is eminent in all fields for a cognitive development. Ventures like Co-lab have been envisioned as successful beginning towards building an integrated approach for collaboration, modeling and inquiry. [14]

Also social networking websites in recent year have led us to believe in the power of developing a web based communication system. With the advent of online social networking as shown by Gross et.al people can communicate their ideas and thoughts to a wide audience of linked and relevant user. [15] However to promote a scientific ideas based on online networking we believe that a better mediator is needed to scan through relevant research and innovations by investors and effectively reduce search time.

Introduction

The paper discusses the possible effects and methods of target based sharing of scientific ideas and expertise through an online portal. Online portals are already in vogue for spreading ideas and social networking in the current form. The study points to modes of popularising the same and their respective outputs on the different segment of users. The study aims to aid any future development of scientific communication based websites and planning of promoting the same to target user bases with a focus on geographic factors.

The study is based on an online portal that caters to connecting innovations and research to potential users. Researchers register their novel idea in the online forum, with relevant details and relevant expertise in the area of the proposed work. Ideas are invited from broad spectrum of innovators, like school students with an innovative device to laboratories with cutting edge technologies. Prospective registered student researchers are connected to relevant research labs for towards developing feasible technologies.

Potential investors and companies can also register with the online portal and are kept updated with the relevant innovative ideas and research in their field of interest. Small and middle level companies which shun form buying expensive green technologies can connect to indigenous research labs for building alternate technologies. They are updated using a no-profit based peer reviewed system towards the merits of potential research proposal, towards an optimized decision based investment.

The website acts as a connecting media, between researchers and investors. It open sources innovative idea from grass root level to the cutting edge of science, presented to competing investors.

The novel effort aims in stimulating original scientific thought towards building greener technologies, and making them feasible by connecting to relevant investors. It also promises to make basic research pursued in universities and national laboratories to strive toward building technologies based on concurrent basic research relevant to their own expertise. Investors find a plethora of innovative technologies, from basic ideas to peers in respective fields, with a vast spectrum of investment towards developing technologies. It eliminates present practice of funding research only in peer reviewed groups at national laboratories and promotes small investors towards small practicable science initiatives.

We have studied the different modes to promote the same among different user groups of researchers, about the potential of different groups of researchers to contribute, and its impact on industries. The work gives a guideline for development in future promotion of scientific ideas through web based online portals.

The co-relation between the researcher i.e. innovator, intermediate website and the industry accepting the research are shown by a pictographical relation in figure 1. The figure shows possibilities of transfer of ideas and paper is aimed in studying how each factor adds towards successful transfer of ideas between R (Researcher /innovator), M (Intermediate online portal) and I (industry).

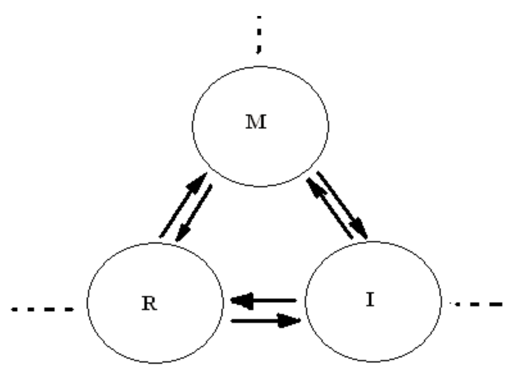

Figure 1. Knowledge transfer co-relation between Innovator, Intermediate website and Industry

Method

The methods of tabulating the following database and co-relations are based on a real time analysis of a said web based effort http://www.thinkbisoln.com for promotion of scientific ideas and their transfer to industrial and corporate solutions. The user registers online, supplying his innovation and expertise detail using an online form as shown in Fig 2. Questions marked with “*” are compulsory query fields. The analysis is based on real time data collected on the said website.

Information diffusion towards promotion of online site through different medium

For promotion of the said technology we have used different methods to convince to audience about its utility. This survey tabulates the diffusion of promotional information about the technology through various medium of communication i.e. online promotion, promotion at international conferences, journals, event sponsoring and trade pamphlets and catalogues.

After each promotional event was organised the number of users registering on the site was monitored using the mandatory third query in Section 4 of Fig 2 which gave source of promotional information about the said website for individual users.

1.Personal Data	
***First Name:**	
Middle Name(s):	
***Last Name:**	
***Birth Date:**	
***Nationality:**	
***Academic Title:**	
Scientific Discipline:	
Permanent Appointment: Yes /No	

2 .Institution	
***Current Institute:**	
***Address:**	
Webpage:	
***From Date :**	
***To Date :**	
*Exact Degree title:	
Scholarships held :	

3. Research contribution	
Publication :	
Number of foreign publications:	
Average Impact factor:	
***Research Interest:**	

4. Solutions I want to provide: (200 characters)	
*What is your current level of work in the solution you want to provide: (200 words)	
***Category**	**Pharmaceutical** **Biomedical** **Biomechanical systems** Green pathways Green software **Green technologies**

*How did you came to know about the site ?

Figure 2. Questionnaire to tabulate registered user's data.

The comparative study of flow of information from researchers based on expertise

Here we have done a survey of the registered user profiles. The systematic study uses the registered user's database of http://www.thinkbisoln.com as collected using the Form in Fig.2, to gauge the propensity of usage of online technological transfer websites along with a percentage of contribution. It was assumed that all age groups were equally susceptible to know how, about the presence of the site and information diffusion regarding promotion has an even distribution across age groups. The contributions were weighted using the Y. F. Le Coadic et.al. diffusion parameter based on t(timing), N(audience) constant for different medium.[8]

Media of communication	Technology		
	t	N	
Journal publication		19	10,000
Patent		36	
1,000			
National conference		16	1,000

Figure 3. Diffusion Parameters by Y. F. Le Coadic et.al

The weighted value for each age group was called expertise and the contribution is defined as shown in Equation ii.

$$PC = (E \times PP \times 100) / \sum C \qquad \{ii\}$$

PC = Percentage of expertise, E = Expertise, PP = Percentage of profile and C = Contribution

Propensity of transfer of technology to industry

Different allied industries were questioned on their eagerness to accept innovations targeted as low cost alternatives to and tallied against the actual integration rate. This study shows the effectiveness of knowledge transfer with relevance to the industry. The surveyed industries are pharmaceutical, biomedical, green chemistry, green information technology, and waste processing industry. The differences give us an idea towards market opportunities and saturations for promoting research in relevant industrial sectors.

Analysis

Information diffusion towards promotion of online site through different medium

Information diffusion graphs plotted shows that rate of diffusion of information is highest in international conference, event sponsoring, trade catalogues, journals and online promotion in order of merit as shown in Fig 4.However the rate of penetrance is inversely proportional to the residence time. So for short term promotions International Conferences seemed promising as for longer impact time online promotion is recommended.

The comparative study of flow of information from researchers based on expertise

Expertise and probability of registrations are two most important factors that help web promoters to focus on target user groups. Here we have segregated users based on there age and have mathematically asserted the most prominent user group that should be targeted for online registration. The analysis shows peaks at age group twenty five to thirty five in terms of balance between web usage and relevant expertise. The expertise is calculated as a stochastic diffusion parameter with up to ten percentage error limit. With wider penetration of web usage across age groups the trend should tend to move towards the right of the curve.

Propensity of transfer of technology to industry

The survey shows the possibility of growth of innovation transfer in case of pharmaceutical, biomedical, green information technology and waste processing industry. However the green information based services seem to have the maximum growth potential among the surveyed industries. The green chemistry section shows a minor negative growth compared to predicted growth within stochastic limits hence has a saturated market.

Conclusion

The study clearly shows the possibility of advent of web based technology for promotion of open sourcing of scientific ideas. Marketing of the brand needs to be done with an overall balance between rate of promotion and

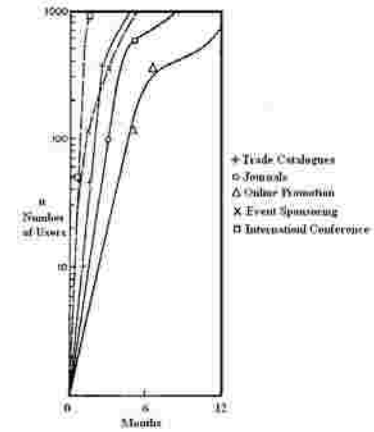

Figure 4. A survey of the information diffusion graph towards website promotion

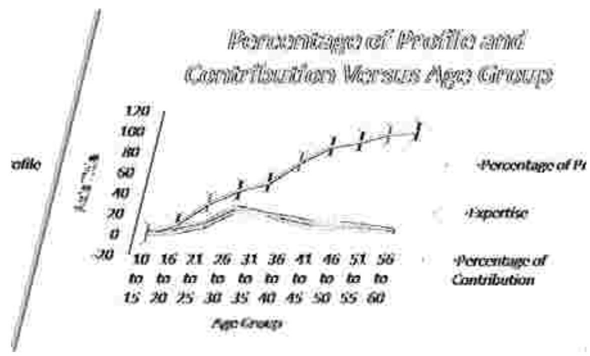

Figure 5. Comparative study of registered users and expertise

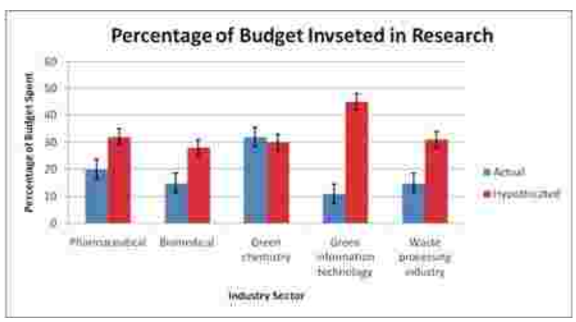

Figure 6. Propensity of transfer of technology to industry

residence time depending on the nature of promotion. The researcher database is prone to be most useful in the twenty six to thirty six years where there is a stable blend of expertise and openness to usage of the internet, prone to maximum contribution towards online innovation promotion. Multiple industries find scope for a web innovation transfer to grow with a higher propensity in areas like Green information technology and Waste processing industry.

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67. Muddying the waters or clearing the stream? Open Science as a communication medium

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Abstract. Open Science is an approach to the conduct of science in which the whole of an ongoing scientific investigation–data, ideas, questions, plans, results and more–is made available online. Open Science began as a way to facilitate the workings of multi-site and multi-national research collaborations but practitioners may choose to adopt it as much for philosophical as for pragmatic reasons. Conducting research as ‘open science’ has implications for research practice, peer-review, trust and reputation, publishing and access.

Open Science projects exist through and depend on the Internet; therefore they are potentially accessible to audiences–including public audiences–beyond the research groups that generate their content. Thus Open Science offers both a novel medium for direct, unmediated access to the process of science and an innovative method for scientists to communicate about their work live, unedited and in real-time.

Does Open Science clear the stream of communication through direct access or muddy the waters with unfocussed, unclear and unvetted comment? This paper will discuss recent analysis of data derived from interviews and case-studies to probe these issues more fully. The analysis suggests that adopting an Open Science approach will allow the capture of an authentic and clear record of research as well as increase and improve access to research outputs. However, researchers acknowledge that this involves opening themselves and their work up to a different quality of scrutiny. For researchers, Open Science both enhances the development of collaboration and communication among research groups and is a way for publicly-funded researchers to meet their responsibilities to communicate with the wider public. Open Science can allow members of the public to contribute directly to research although the need for contextualisation of complex science may place demands on researchers’ time and skills.

68. Quantitative Indicator Design of Science Popularization Performance of Science Museums

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Abstract. There was no mature evaluation system to judge the science popularization achievement and effect of science museums in the mainland of China previously, especially no objective evaluation indicators. This article designs 10 quantitative evaluation indicators from the science popularization environment, science popularization achievement and social recognition of science museums. This set of indicators forms a practical evaluation system of science popularization performance of science museums. The system data are easy to get, the evaluation is objective, comparative and applicable.

Keywords: Science Museum, Science Popularization Function, Performance Evaluation, Quantitative Indicator System, Design

69. A Model of Evaluation on Large-scale Science Communication Events

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Abstract. Based on the evaluations of the China Science Communication Day at the Beijing Venue in 2007, 2008 and 2009, undertaken by the China Research Institute for Science Popularization, a comprehensive model designed to evaluate large-scale science communication events was developed. The evaluation, composed of four parts (public evaluation, organizer and volunteer evaluation, specialist evaluation and media evaluation) is a combination of both qualitative and quantitive study. It is supposed to be applied to a science communication event with both traditional displays and modern hands-on exhibits and activities. The evaluation focuses mainly on measuring the effects of the science communication event. It also concerns the forms, content, on-spot services and promotion of the event, all of which are considered to be relative to the effect of the science communication event. The public evaluation is designed to acquire the public's feedback to the science communication event. On-spot questionnaire survey, call questionnaire survey, observation and interview are all adopted in the public evaluation. The on-spot questionnaire survey, subsidized by observation and an interview, aims to chart the event's influence on the public and the public's positive reaction to the event. Also, any comments or preferences on the forms and contents are noted and the details regarding how individuals were initially made aware of the event are transcribed. A call questionaire survey is also utilized to attain the public's level of awareness. The organizer and volunteer evaluations mainly focus on staff comments and suggestions regarding the organization of the science communication event and its undertaking in general. It also investigates what skills or knowledge the staff acquired after such communication with the public and, furthermore, inquires as to what the staff considers the public's preference regarding the form and content of the event to be. The questionnaire survey and interview are adopted in the organizer and volunteer evaluation. The Specialist Evaluation is designed to attain suggestions and comments regarding the science communication event (concerning mainly the construction of the event) from about 10 professors and engineers who specialize in fields related to science communication, science education or a field related to the theme of the event itself. A group interview has proven an effective way to evaluate. The Media evaluation examines how newspaper, TV, radio and the internet report the science communication event, and aims to find effective ways to improve the public's awareness of the science communication event.

Keywords: Evaluation, Model, Large-scale, Science communication event

70. Effectiveness of Participatory Approaches for Science Communication Strategies: A Comparative Study in Taiwan and Japan

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Abstract. Public Understanding of Science and Technology (PUST) has been addressed and implemented in Japan since 2002 in Biotechnology Strategy Guidelines Japan (BT Japan). The BT Japan has clearly demonstrated to improve public engagement for science literacy in the general public in Japan. In response to White paper, there are various kinds of activities organized by different stakeholders such as governmental organizations (GO), governmental organizations (NGO), academic or research intuitions, and private sectors in Japan. Currently, Taiwan is still lacking of long-term science communication strategies or public engagement on S&T mechanisms. PUST or "science communication" is just at the beginning stages for Taiwanese stakeholders, particularly the governments of Taiwan. They are in the progress to establish S&T policies to improve science communication, including public engagement and understanding of S&T etc.

This paper reviews the current status and addresses the challenges and requirements it faces in implementing science communication strategies in Taiwan and Japan, by analyzing the following issues: (1) science communication strategies under the framework of biotechnology policies, from the policy to practice; (2) summaries the current public engagement activities by different stakeholders, particularly on participatory approaches; (3) science communication education/training programs in higher education. Based on review results, it compares status of Taiwan and Japan.

Overall, this paper proposes long-term strategies to improve two-way science communication in Taiwan, particularly the effectiveness of participatory approaches by referring from Japanese experiences and a polite study of Taiwan Science Café in 2006. It is partly to respond to the recommendations of S&T policies in Taiwan. The proposal includes the possibility of developing a model for public engagement activities that incorporate the needs of different stakeholders to achieve public literacy and understanding of S&T by informal learning system for the general public. This proposal is not only related to science communication strategies but also the issues of capacity building for science communication and its roles in different cultural societies.

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Keywords: Participatory approaches, Science & technology policy, Science communication strategies, Taiwan, Japan, Comparative study

71. Learning Mathematics Through Origami

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Abstract. In our schools, mathematics is a dreaded subject, perhaps even more so than other subjects like physics, chemistry and biology. One reason for this, it is believed, is that whatever is taught in the name of these subjects has little or nothing to do with real life. Experience has shown that once a clear link can be established, the teaching and learning of the subject at once becomes agreeable and enjoyable, the dread dissolves and children start loving it.

Today school mathematics is totally cut off from real life. The entire curriculum seems to be overlaid. In this process the entire delight and beauty of mathematics has got buried. Today, any school worth its salt, would boast of a physics, chemistry and biology laboratory-all agleam with the most modern gadgetry. Rare is a school which has even thought of having a mathematics lab. It is thought that mathematics is best learnt by mugging up tables and by repeatedly solving boring sums. Most of the children are scared of mathematics and carry the burden of it through precious years in school. If children are to appreciate the beauty of mathematics, it is imperative, that they get a feel for mathematics through practical work.

Origami is the Japanese art, the meaning of origami Ori = to fold & Gami = paper, simply we can say, origami is nothing but the paper folding. By systematically folding a paper, one could fold lots of angles, polygons, curves and 3-D polyhedral, by this method one can learn a lot of concrete mathematics.

For origami no special paper required, however stationary shops cell origami papers, which are thin sheets of paper colored on one side, that are squares of different colors, stacked together in packets. But for models ordinary paper will sufficient. Even computer stationary, printed on one side can be used. Discarded photocopy paper can also used as Origami paper. Origami is also a fun-filled activity in itself as well as an approach to enhancing one's mathematics especially geometrical thinking while developing co-ordination between one thought and action.

72. The Analysis of Social and Cultural Factors in Science Communication

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This paper analyses the roles of social and cultural factors in science communication, and this paper point out: science communication is deeply influenced by social and cultural factors. Science communication is influenced and restricted by philosophies in society, social customs, social mentalities, social concepts, men's modes of thinking, moral values, habits and customs, way of behaviour, and so on. They often affect and restrict the way, method, direction, channel, aim, content, process, result of science communication, and so on. The process of science communication deeply bears the stamp of social and cultural factors.

Keywords: science communication, social and cultural factors, analysis

73. Values and Evaluation: Observations of Emergent Engagement

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Abstract. Use of the term “engagement” in science communication has arguably become the fashion of the times. But while the motivations for, and intended outcomes of engagement have been discussed widely, the value of engagement activities is difficult to demonstrate. I argue that this issue is reflected in the difficulties encountered in the evaluation of these activities and suggest that for an engagement process to be truly participative, participants should also be included in establishing the value of (i.e., evaluating) the activity.

In this paper I will provide an exploratory account of a particular instance of emergent engagement—the formation of a group of farmers called Climate Champions. The Climate Champions program was established in recognition of the role of peer interaction in how farmers gain new knowledge and adopt new practices. It aims to put farmers who are knowledgeable about managing and adapting to climate variability and climate change in touch with other farmers. As part of the initial meeting of the group, participants discussed and established their own values for the program.

This research raises two sets of questions that I will consider. First, how can focus groups and conversation transcripts be used in value oriented science communication research? Second, how can values be used to guide further engagement work in evaluation? Through the Climate Champions example, I will explore how engagement processes might be used for soliciting and including values of those who participate. I will discuss the potential effects of facilitation and transcript analysis techniques and the implications of value awareness in engagement activities more generally.

74. Popularising E-Governance for Development

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Abstract. This paper is a brief introduction to the concept and process of e-governance (Electronic Governance) for which innovativeness in the approach and methodologies are significantly required. E-governance is the application of Information Technology to the processes of Government functioning to bring about simple, moral, accountable, responsive and transparent governance. E-Governance' is a network of governmental or non- governmental organizations or a one stop portal that changes the system of delivery of public services and increases the inter connections between the people and government. This process would be successful only if science and technology is popularized. Necessarily it must be popularized among the students, who are the future of nation.

India is a agricultural country. So far the agricultural sector is concern, e-governance refers to the use of ICTs in delivering governance products and services which are of use to farmers or those working in the agrarian sector, including livestock breeders and herders, milk dairy workers, agriculture extensionists, agricultural traders, and NGOs working in the agriculture sector. At the same time, there are a range of governance products and services that are useful for the agrarian community, which lead towards enhancing crop productivity, efficient cattle farm management, providing for national and household level food security, and conservation of biodiversity.

Hence, there is a need to take a holistic view towards the entire e-Governance initiative across the State. To ensure successful application of e-Governance, Government of India has setup an institutional mechanism for formulation of Standards through collaborative efforts of stakeholders like Department of Information Technology (DIT), National Informatics Centre (NIC), Standardization Testing and Quality Certification (STQC), other Government departments, Academia, Technology Experts, Domain Experts, Industry, BIS, NGOs etc. Therefore, the paper tries to examine all significant efforts to popularize the process of e-governance among every sections of the society i.e. farmers, students, administrators, corporate and what not.

75. People' s Perception of Public Participation in Regulatory Decision Making: The Case of Bottled Water Quality Standards in India

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Abstract. The theories on public engagement in scientific and regulatory decision-making have changed rapidly during the last two decades. The regulatory decision making processes, which were completely in the domain of expert's knowledge, have come under severe attack from social scientists, politicians, journalists, and public intellectuals. Questions over 'participatory gap' have been raised by several scholars. This framework follows the pluralist precautionary approach and argues for giving considerable weight and space to non-scientist and other actors in regulatory decision-makings. The debates over public engagement become more intense in the context of genetically modified foods, stem cell research, reproductive cloning, climate change and other contentious issues. In this regard, government policies and participatory mechanisms vary across countries.

Scholars, engaged in quantitative studies on regulatory decision-making processes have propounded the 'deficit theory' which accounts that people do not have enough and proper understanding of technical and scientific issues. This view has been criticised by scholars in later studies. The alternative views propound that people do have the capacity to grasp the implications of many scientific and regulatory decision-making on their day-to-day life. Non-scientists and laypersons decisions become more crucial, on the issues, where the experts themselves were not very certain about the risk generated from scientific and technical problems. Thus, the incorporation of decisions of other actors makes the process pluralistic, transparent, and democratic in nature, and leads to greater acceptance of regulatory decisions in democratic societies.

In this background, this paper explores the regulatory decision making process for setting quality standards of bottled water in India. The paper also attempts to explore the public understanding of regulatory decision-making and their opinion over expert's committee composition. Through primary survey, the study explores three basic premises: the awareness of people towards regulatory bodies and its implications over their decision-making, their willingness to participate in decision-making process and their perception of the composition of the expert committee.

In the study it was found, that majority of the respondents were aware about the regulatory body. Apparently, the scientific and technical parameters used by BIS for setting quality standards do not connotes much meaning to them, and perhaps, they trust other parameters to judge drinking water quality. Here, it was also found that people were highly willing to participate in the decision making process of standards setting. The individuals in the least educated category were more willing to participate in the standard setting exercise. Where as, people belonging to the highest category of education want to leave it to the 'experts'. This suggests that people perception over scientific authority and validity varies across different sections of society. Over the issue of composition of expert committee for setting standards for bottled water, it was found that people posed more faith in government and consumer organisations. Only thirteen per cent of the respondents felt that there is a need to have representatives of industry groups in the expert committee. This is in sharp contrast with the present composition of these regulatory bodies where around forty percent experts are industry representatives.

76. Choosing Effective Frames to Communicate Animal Welfare Issues

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Abstract. Animal welfare organisations use multiple communication frames, but it is unclear which ones are most effective in promoting attitudinal and behavioural change. This paper reviews framing techniques that draw on shocking imagery, measures of animal intelligence, societal norms and celebrity promotion. Societal norms and celebrity promotions have the greatest potential to modify attitudes and behaviour as they are accessible and relevant to the general public, unlike frames promoting animal intelligence. Shock frames are also effective, but should be avoided as they may provoke audience backlash and reduce the credibility of the organisation.

Keywords: Animal welfare, Celebrity, Framing, Social norms

Introduction

Most societal and scientific issues can be approached from different viewpoints, emphasising different values and considerations of the same essential argument. Choosing a single viewpoint for communicating an issue is known as framing and can have significant effects on the way in which the audience responds (Chong & Druckman, 2007). Animal welfare is a good case study for studying the influence of framing, as it is an issue that has an extremely broad potential audience who hold conflicting values and viewpoints.

Animal welfare is highly valued by the general public (Bennett, 1998), but most people lack knowledge about specific welfare topics (Tawse, 2010). In theory, this means that there is a large audience who are prepared to act on animal welfare issues if the relevant organisations can communicate their message effectively.

It is important to note the difference between animal rights and animal welfare. Animal rights philosophy argues that animals have rights and should therefore not be used by humans for any purpose (Regan, 2004). Animal welfare considers animal use acceptable as long as it is done humanely (Carenzi & Verga, 2009; Dawkins, 2006). For example, an animal rights activist might boycott meat entirely, whereas a person who values animal welfare may seek out free-range products rather than factory farmed animals. This more moderate viewpoint asks people to make small changes to their consumer behaviour, a much realistic communication goal than the major lifestyle changes required by animal rights groups (Mika, 2006).

Both animal rights and animal welfare societies have a long history of using shocking images to raise awareness of animal suffering. For example, past advertisements have included graphic depictions of face-branding cattle, euthanized animal shelter kittens, and blood pouring from a fur coat (Jones, 1997).

Yet shock tactics may be counterproductive, distressing viewers but leaving them unwilling or unable to act on their emotions. This effect has been observed in climate change campaigning, where negative fear-laden frames are thought to disempower the audience and fail to encourage deeper engagement (O'Neill & Nicholson-Cole, 2009). Likewise, humanitarian charities are finding that people can become overwhelmed and seek to justify their apathy by questioning the validity of aid organisations (Seu, 2010).

Negative framing in political advertising has been shown to produce a backlash against the attacker (Jasperson & Fan, 2002), but even more of a concern is that long-term negative campaigning can reduce public trust in the government and the political system (Lau, Sigelman, & Rovner, 2007). Consequently, it is important to consider whether shock frames are a useful tool for animal welfare activists or whether their continued use may lower the credibility of the entire movement.

Thus, the aim of this paper is to review common frames in animal welfare and develop predictions of their efficacy.

Animal Welfare and Moral Shocks

Animal rights activists and previous researchers have concluded that shock tactics are their most powerful tool, eliciting audience attention and prompting action. University students exposed to depressing, negative images of dogs were willing to donate more money and time than if exposed to a warm, happy dog (Haynes, Thornton, & Jones, 2004). Jaspar and Poulsen (1995) found that most members of animal rights groups were recruited through shocking images and literature.

However, there are some important drawbacks to using a shock frame. Apart from the fact that overly explicit images are frequently banned or refused by advertisers (PETA, 2010), shock frames may only appeal to a limited segment of the population. Animal rights groups are predominantly made up of women – over 70% in most groups (Herzog, 2007) ¬– who are non-religious college graduates (Jasper & Poulsen, 1995; Mika, 2006). The frames which are effective for this group may alienate others (Mika, 2006).

Many consumers may simply avoid or switch-off to advertisements that they find emotionally distressing. Studies demonstrating the effectiveness of shock frames are normally conducted on captive participants (eg. Haynes, et al., 2004), but a more realistic situation is described by advertising creative director Andy Firth who said,

You can see animal welfare ads a mile off. A sad looking animal and you already know what it's about. Consequently, you choose not to read it. You already know how it will make you feel. (Duncan, 2008)

The counter productive nature of shock tactics has been observed in animal welfare campaigns. Mika (2006) looked at morally shocking advertisements for vegetarianism and found that non-activists had a nearly unanimously negative reaction. Many people were offended and expressed reduced support for the advertiser.

In summary, negative shock framing may be effective at attracting attention, but also risks alienating large sections of the audience. As such, it is only a worthwhile communication strategy if there are no viable alternative frames.

Framing Animals as Intelligent Beings

One strategy growing in popularity amongst animal welfare organisations is to frame animals as intelligent beings. The information used in these frames is normally based on sound, scientific research in animal cognition. For example, the Animals Australia 'Free Betty' campaign against battery eggs states that a chicken, 'can recognise over 100 of her friends by their facial features' and that her calls, 'communicate a wealth of information' (Fig. 1); both claims are supported by research (Bradshaw, 1991; Evans & Evans, 1999).

Although the Free Betty campaign still makes use of graphic imagery, the dominant frame is that chickens are intelligent and therefore worthy of our care. This line of thinking is also popular in the scientific literature. The argument runs that suffering can only be present if you are consciously aware of it. Therefore, we do not need to be concerned for the welfare of animals that do not experience pain and have low mental capacity. Once there is reason to suspect that an animal is sentient than we have a moral imperative to safeguard their welfare (eg. Broom, 2007; Brydges & Braithwaite, 2008).

On the surface, the lay public seems to agree with the scientific consensus; people who have a higher level of belief in animal intelligence are less likely to support the use of animals by humans (Knight, Vrij, Cherryman, & Nunkoosing, 2004). However, evidence suggests that people attribute intelligence to animals they already like, such as cats and dogs, but do not necessarily decide to protect animals they discover to be intelligent (Knight & Barnett, 2008).

People who deal with dilemmas about animal intelligence, such as working with laboratory rats while simultaneously keeping a pet rat, may even justify their behaviour and reduce emotional conflict by crediting some individuals with being special or smarter compared to the rest of the species (Knight & Barnett, 2008; Serpell, 2009).

Effective frames are easily accessible and resonate with the existing beliefs of the audience (Chong & Druckman, 2007). The frame of farm animals as intelligent creatures meets neither of these criteria; it is an unfamiliar concept to most people and contradicts popular beliefs. Additionally, people seem to be adept at mentally manipulating information about animal intelligence to suit their behaviour.

Despite this, there is evidence to suggest that long-term promotion of intelligence frames, coupled with educational programs, can change social perceptions of some species (Goedeke, 2004). However, if this is the ultimate aim of the communication strategy then it might be more efficient to target social norms directly.

Framing Animal Welfare as a Social Norm

People usually behave according to their beliefs about what is considered normal and acceptable within society (reviewed in Cialdini & Goldstein, 2004). Social norms are a powerful driver of human behaviour, affecting everything from participation in recycling to reducing binge drinking and the extent of their effects are probably still underestimated (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008).

Because norms are important for building relationships with others and constructing self identity (Cialdini &

Goldstein, 2004) they are immediately accessible and relevant to an audience, making them an effective communication frame (Chong & Druckman, 2007). For example, the most important factor in determining if dog owners would take part in recommended activities such as obedience training were their beliefs about the expectations of friends and family (Rohlf, Bennett, Toukhsati, & Coleman, 2010).

Social norms are also important for influencing donations; men gave more money to a public radio station when they received descriptive information about the amount most people gave (Croson, Handy, & Shang, 2010). This is potentially important for animal welfare organisations as men are generally less sympathetic to animal welfare compared to women (Herzog, 2007). Men and women also differ in the type of animal abuse they engage in, with men more likely to violently attack animals while women more often hoard and neglect animals (Herzog, 2007). It may be useful for animal welfare organisations to separate these aspects of animal abuse and run campaigns using social norm framing to target men and traditional shock frames to target women.

The RSPCA is one of the most credible and well-known animal welfare organisations in the UK and Australia (Hughes, 1995). Their advertisements emphasize the social acceptance of animal welfare goals and encourage people to become a supporter (see Fig. 2 for an example). Like many social movements, animal welfare and rights are heavily involved in Web 2.0 and internet networking which provides them with a cost-effective method of reaching a broader range of people (Loader, 2008). There is little information on how internet communities provide information and construct social norms. However, recall of political information was increased in students who friended a politically- orientated profile on Facebook (Teresi, 2009).

Celebrity-based Frames

Another aspect of social norm framing is the use of celebrities as role models and promoters. It is accepted within the advertising industry that associating a product with well-known and attractive celebrities can increase sales (Amos, Holmes, & Strutton, 2008). The key factors in determining the success of a campaign are the credibility of the celebrity and that the celebrity and product are well-matched (Till, Stanley, & Priluck, 2008). Both factors are important in ensuring the frame is accessible and pertinent to the audience.

PETA is especially renowned for using celebrities (eg. The Daily Telegraph, 2010) but the effectiveness of their approach is questionable. Going for quantity over quality, PETA celebrities often have no direct link to animal welfare and are portrayed in a sexualized fashion. This has raised questions about the credibility of the organisation and generated feminist debates (Deckha, 2008).

A better example of effective use of celebrity can be seen in Jamie Oliver's television phenomena 'Jamie's Fowl Dinners' and the follow-up 'Jamie Saves Our Bacon' (Klein, 2009; Van Someren & Ward, 2008). As a celebrity chef, Jamie Oliver is well matched to encourage consumers to cook using free-range animal products (Gerodimos, 2008). News outlets hailed 'Fowl Dinners' as an unqualified success, claiming it increased sales of free-range chicken by 35% (Hickman, 2008). Although it is yet to be shown whether the impact was long lasting, consumer associations with celebrities are thought to be memorable (Till, et al., 2008).

Discussion

Animal welfare groups have traditionally used shock frames to mobilize support, but there is increasing concern that this approach alienates the public and reduces organizational credibility. Frames focusing on social norms and celebrities are likely to be the most effective frames for encouraging positive attitudes and behavioural change. Both these frames are immediately accessible and relevant to the general public, unlike the frame of animal intelligence.

The next logical step for research is to test these predictions using field testing and experimental manipulation of frames. Such an experiment would have to be carefully designed; even simple manipulations of an image can have unexpected effects (Haynes, et al., 2004), while preserving an image and changing the framing text can lead to a disconnect between the words and the visuals (Nabi, 1998).

This study has important implications for the broader field of science communication. Communicators should be aware that, although they are effective, negative frames can result in audience backlash when employed for long-term campaigns. We also note the potential role of Web 2.0 social networking in the formation of social norms and an urgent need for research in this area.

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77. BioSense Project as a Dialogical Model

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Abstract. Effective engagement of science with its publics requires: (1) that publics actively appropriate the resources provided by science for more robust capacity for active citizenship; (2) the engagement of scientists and scientific institutions with publics on a collaborative basis for addressing science and technology-based concerns. Our project aims to create the conditions for scientists to understand the plurality and diversity of publics whom they are expected to engage with, as well as developing the capacities and skills required for a constructive interaction for dealing with publicly relevant issues. We will use Science Shop models, which have been part of the landscape of the public engagement with science in many European countries and beyond and that have been a very important means of democratisation of science. The diversity of experiences in this field provides a very rich repertoire of organisational models, initiatives and modes of articulation of the concerns of scientists and scientific institutions and different kinds of publics. However, the experience of Science shops is unevenly distributed across countries, and Europe is not an exception. Portugal is a conspicuous case of absence of experience with science shops. In this project, the science shop will be thematically oriented towards issues related to the life sciences in society. It is expected to address both issues in biological and biomedical research that are matters of public concern and controversy (through the organisation of debates, deliberative fora, online fora and exchanges, performances and exhibitions), and issues raised by specific publics, such as matters of food safety, animal welfare, public health, health care or reproductive health. The institutions involved in this project are active in the fields of the life and biomedical sciences and of the social sciences, with a standing commitment to the development of science-society relationships, based on transdisciplinary approaches bringing together the life, biomedical and social sciences and the arts. This will be achieved through the creation of an infrastructure for the continuing support of the work of the science shop and for communication; the identification and "interessment" of a variety of publics; the training of mediators/facilitators for science shop activities; the development of pilot activities as a "demonstration effect" of the potential of science shops for promoting science- society dialogues and collaborations; and the dissemination and sharing of experiences with a view to encouraging and supporting the development of other Science shops.

78. SERI- Information Kiosks- Science Communication and Beyond

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Abstract. In this Information Technology age, most of the people in the developed countries and a substantial section of the population in the developing countries like India access the internet to seek information on various subjects, thanks to the information and communication technologies (ICT). But, In many developing and under developed countries, there is still a substantial number of people who have no access to such technologies as a result of which they are disadvantaged in their access to information. This is specifically true in case of farming community. And Sericulture and Silk industry are no exception to it. The phenomenal growth in silk production in the country during last two decades was largely due to the series of research breakthroughs made by various research organizations of the Central Silk Board like, evolution of productive bivoltine silkworm breeds/mulberry varieties, appropriate rearing technologies for bivoltine races and cross-breeds, package of practices, etc. Though, Central Silk Board and state Departments of Sericulture of different states are actively involved in taking such technologies and recent findings to the stakeholders through their extension networks effectively, yet in order to strengthen the extension network through IT initiatives Central Silk Board developed Seri-information Kiosks in English and regional languages. These touch screen kiosks have helped sericulturists to access sericulture and silk related technologies/information actually on finger tips! They mainly provide information on new mulberry varieties; silkworm races; packages of practices; diseases/pests and their control measures; seasonal forewarning; reeling; wet processing; weaving; training programmes; projects/ schemes; market information; details of manufacturers/dealers of sericultural appliances/ chemicals, etc. The market information on cocoon and silk at designated markets is updated on day to day basis. These Kiosks have been already working in few selected sericultural states successfully. The farmers have been utilizing these touch screen kiosks for their requirement. Still efforts are on by the CSB to bring in these units under on-line connectivity for updating the market rates of cocoons and silk on hourly basis. Now, efforts are being made to put these kiosks on interactive mode, connecting the stakeholders with the Research Institutes of the CSB and Departments of Sericulture.

Keywords: SERI-information Kiosks, Information and Communication Technologies, Sericulture

79. Virtual and Substantial Vectors in Science and Technology Museum—Comparison and Analysis of Chinese and Foreign Popular Science Exhibitions

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Abstract. With the development of world science and technology, global exhibition educational programme has entered into a new era. Currently, among 186 countries in the world, Europe, America, Japan and other developed countries have utilized the "4D virtual imaging" as one of the important methods to popularize the science technologies and social conventions. The trend will be completed in a relatively high speed as a consequence of time lapsing and explosive updates in technologies. It can be forecasted in the future. Virtual technology will not only coexist with the entity exhibition but also become a primary educational method.

This paper compares Chinese and Foreign science exhibitions from the aspects such as: the exhibition theories, designs, contents, and the building of circumstances. Try to find the flaws then correct them. At the same time, we have browsed the world famous virtual science and technology museum network, such as New York Science and Technology Museum, Washington Science and Technology Museum, US Astronaut Science and Technology Museum, Lincoln Memorial and so on. Using statistics to do our research. Meanwhile, we combined these with the reality of our country, analyzed the differences in science technology vectors; audience groups and communication effects. In the future, how to take advantage of new technology to complete science enterprise should be emphasized.

Nowadays, science and technology museums should attract visitors by using novel exhibition methods, The museums can make them perceive the technology and experience the technology from a total different aspect of view. For the purpose of revealing the uniqueness of science, the meanings can not be limited but should be renewed continuously to touch the audiences' senses. The author believes that the combination between virtual and substantial technology is the only path develop in the future.

80. Mentoring Network Model and Evaluation Scheme

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Abstract. Little is known about the evaluation scheme of measuring how successful a mentoring is. There are no tools of success factors for formal mentoring program. In this presentation we introduce the Mentoring Network Model (MNM) based on a formal mentoring program at the WISE (Women into Science & Engineering) Main Center at Ewha Womans University.

The Mentoring Network Model (MNM) is a visualizing model to represent the human networks among mentors and protégés by using a network diagram. The model contains not only people participated in the mentoring but also all members' relations such as friendship, alumnae, colleagues in the same organization, and neighbor.

By assigning three factors- node, relation and field to the MNM, we analyze the MNM. The nodes represent members and relations between two nodes are expressed by a line and the field is the physical or virtual area representing nodes and the relation in a 2-demension rectangle. If some mentors are belonged to same department of an organization, they can be assigned in same field.

We introduce three indexes- affinity, time and grid-complexity related to the relation of MNM. Affinity (A) is an index for affinity between two members. The affinity is based on the age gap, locality, and personality. We assume the closer network, the better condition for mentoring. The second index, time (T) represents the quantity or time of mentoring activities. We assume the more frequent on-line and off-line interactions between two persons make the index T bigger. The last index, grid-complexity (G), is a complexity index that shows how many relations per node exist in a model. By defining three factors and indices to MNM, we introduce an evaluation scheme how successful the mentoring is. We apply this MNM to WISE mentoring fellow program.

Keywords: Mentoring model, Mentoring network model

81. New Frontiers in Science Communication: Researchers' Experiences of Coming Out of the Laboratory

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Abstract. What happens when researchers come out of the laboratory and explore new frontiers in science communication? This question is explored here by considering a series of case study projects within the UK linked together with the common theme of robotics technology. We will discuss what the researchers brought to the project in terms of audience engagement and the impacts on the researchers as a result of their involvement.

Robotics technology was specifically chosen as the focus for investigation since robots are frequently perceived as exciting and intrinsically compelling, therefore as a subject area are a low barrier when communicating with public audiences. Activities can range from basic physical and engineering processes and hands-on building workshops to demonstrations using state-of-the-art components from robotics research or industry. In more recent times robotics-related public engagement events have also included consideration of the social and ethical questions that arise from robotics research.

In late 2006 the UK Engineering and Physical Sciences Research Council funded Walking with Robots, a network which provided focus and support for robotics researchers, enthusiasts and representatives from UK industry to engage public audiences with their work. A variety of flagship projects and events developed out of this network, often with very different approaches and outcomes but each, at the core, about direct contact between those at the cutting edge of robotics technology and a public audience. This paper will contrast the findings from the Walking with Robots programme and three of its associated projects: Heart Robot (a fusion of robotics and buraku puppetry to engage audiences at carnivals and street theatre); Robotic Visions (a UK wide youth engagement project); and a training programme aimed at early career researchers in robotics.

Public audiences often reacted very positively to the fact that those delivering the activities were researchers or scientists, and on many occasions would identify the involvement of a scientist or engineer as the 'best part' of an event or activity. Impacts on the researchers were varied. For some, taking part in a project or an event meant being part of a rewarding experience that reinforced existing positive feelings and enthusiasm about public engagement. Others met new contacts, learned new skills or became familiar with novel approaches to public engagement. Others heard ideas about robots from outside of their normal working environment, or developed a greater understanding about what audiences think and feel about robots which provoked wider discussion back at the laboratory. In some cases involvement in the science communication projects has prompted researchers to reflect on their motivations for taking part in public engagement activities more widely. In considering the wider learning from researchers' experience in a robotics context the paper will reflect on how that might apply more generally to researchers involved in direct contact with public audiences.

82. A Study on the Application of Knowledge Management to Raise the Effects of Science Communication–A Case of Training and Education in Science Centers & Science Museums

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Abstract. By now, many enterprises have implemented knowledge management (KM) and achieved remarkable success. According to the theory of KM, knowledge can be divided into explicit knowledge and tacit knowledge. Explicit knowledge is knowledge that has been or can be articulated, codified, and stored in certain media. It can be readily transmitted to others. The most common forms of explicit knowledge are manuals, documents and procedures. As opposed to explicit knowledge, tacit knowledge is knowledge that is difficult to transfer to another person by means of writing it down or verbalizing it. The most common forms of tacit knowledge are know-how, discernment, intuition, comprehension, belief, ideals, values, emotion and mental model.

In Science communication, scientific knowledge belongs to explicit knowledge, whereas scientific spirit, thinking and methods belong to tacit knowledge. Tacit knowledge is more important and difficult than explicit knowledge in the process of science communication. Because training and education in science centers & science museums (TESCSM) is a kind of science communication , it is taken as an example in this paper to demonstrate the necessity and measures of the implementation of KM.

With rich contents, science centers & science museums provide different training and education for different people such as children, pupils, volunteers, teachers from middle school and primary school, staff from science centers & science museums. The benefits of KM are as follows:

1. Improving the professional ability of teachers;
2. Increasing the study results of students;
3. Assisting students to master scientific knowledge, scientific spirit, thinking and method

better. To obtain these goals, the following measures should be put into effect well:

1. Tacit knowledge communication between teachers;
2. Tacit knowledge communication between students;
3. Tacit knowledge communication between teachers and students;
4. Personal knowledge management;
5. Turning personal knowledge into organizational knowledge;
6. Constructing the network of knowledge sharing.

The paper will discuss those problems in detail and draw a conclusion that the implementation of KM in science communication can raise its effects.

83. Scientific Conversations Outside Science Programmes Contexts: A Case Study Analysis

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Abstract. Several excellent articles and books have been written in the last decades on the analysis of science programmes of traditional media. Throughout the years scientific programmes of radio stations and televisions all around the world have been studied and observed with methodologies coming from different fields of social research, while international networks and forums of science journalists where successfully created. This research presents an attempt to focus on a new type of interaction which still takes place in traditional media programmes but escapes traditional contexts of scientific programmes.

Starting from a previous general study on the presence of science in Catalan television this new research has been deepening into the analysis of interactions which occur in a magazine programme called "Els Matins", broadcasted by the main Catalan public channel (TV3). The programme has turned out to be an extremely interesting case study when it comes to science communication as it presents a great variety of actors and interactions whenever dealing with science topics. Being broadcasted every day from Monday to Friday, from 8 am to 1 pm, the programme sees the two presenters going through a series of interviews, debates, news and weekly sections that often involve science topics taken from a variety of fields.

Using the methodology coming from the field of Discourse Analysis, and in particular that of Conversation Analysis, the author has been studying and comparing two main types of interactions which occur inside "Els Matins": the one between the presenters and the invited scientist, which takes place weekly and has a duration of twenty minutes ("Ciència amb Ramon Folch"); and the one between the presenters and the variety of invited guests (such as politicians, researchers, civil associations, citizens, lawyers, etc.) who participate almost daily in interviews and debates on scientific topics – between others. Due to its nature the programme has the tendency to often deal with (but not only) scientific topics which are strongly related with everyday life or to important ethical and political issues. This happens both inside the general debates and in the specific section dedicated to science (i.e. issues related with the advancement of the health system as well as ethical issues in medical research, local environmental problems such as the scarcity of water supply, public funding to scientific research, etc.), which made such a case study even more interesting to analyze.

The work has underlined the importance of studying also the scientific discourse happening outside specific and dedicated contexts - such as science programmes - even when analyzing traditional mass media. It shows how the proximity between the public and the scientific topics/problems/dilemmas/hopes and controversies (through the mediation of the journalists/presenters) increases considerably when dealt with outside specific "media spaces" labeled as science spaces. Relevant results emerged through the analysis have shown how interactional occasions which occur in more general spaces can generate more effective and interactive discourses than one-way interactions that occur inside specifically dedicated spaces.

84. Perception of Coordinators of Graduate Programs in Public Health about Public Science Communication

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Abstract. Bibliometric, scientometric and infometrics studies indicate that Brazilian scientists and researchers are increasingly communicating the results of their research using scientific indexed publications. Factors contributing to this reality are the relatively recent increase in the number of new peer-reviewed journals published in Brazil in the last years, and due particularly, since 1997, to the creation and development in Brazil of the Scientific Electronic Library Online (SciELO). With SciELO was created new mechanisms for evaluating scientific publications, complementary to the traditional Institute for Scientific Information (ISI) and spent to produce indicators of use and impact of scientific journals published on the Internet following the SciELO methodology. As English is the predominant internationally language both in scientific circles as in scientific publications, the SciELO's proposal allows the projection and the increase of the visibility of Brazilian scientific production, as well as of Latin America due the indexation of journals in Portuguese and Spanish.

The Objective of this research is to begin an exploration about public communication of science on the part of Brazilian science producing centers, mostly located in the graduate programs of public universities. Since the strict criteria of scientific communication are already consolidated among Brazilian researchers and scientists, it was established as a proposal of this research to investigate how these researchers and scientists respond to the demand of the Knowledge Society by a public communication of science and technology.

It was chosen the methodological approach of a survey with Graduate Programs in Public Health (GPPH) offered in Brazil and recognized by the Coordination of Improvement of Higher Education Personnel (CAPES), linked directly to the Ministry of Education of Brazil. During the National Forum of Coordinators of GPPH held in May, 2010 at the School of Public Health, University of São Paulo (SPH-USP), was applied to the coordinators a semi-structured questionnaire after that it was analyzed the answer to the question: For you what is public communication of science? Among 41 coordinators, 33 answered the questionnaire.

Three categories of conception of public communication of science and technology (PCST) were found: (1) PCST understood as communication among peers, (2) PCST understood as science communication as extending to the society without necessarily a treatment of language employed in the information transmission and (3) PCST understood as a communication expressed in public language representing at the same time a challenge and also an obligation to scientists and to researchers.

Preliminary conclusions of the analysis of the first stage of this research indicate that the PCST is part of a non-explicit agenda of GGPH that does not constitute at moment a communication policy of those programs. The questionnaire is part of a doctoral research in development at SPH-USP that was approved by the local Ethics Committee (Research Protocol No. 2072). A second stage of the doctoral project that study the PCST production in the GPPH will apply a supplementary questionnaire and interviews that will provide a detailed analysis about the PCST at GGPH recognized by CAPES.

Keywords: PSCT Conception, Graduate Programs in Public Health, Comunication

85. Constructive Study on Equilibrium Model of Science Communication–A case from China Science and Technology Museum

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Abstract. "Dominant model" and "Equilibrium model" were two different patterns in communication used to explain the relationship between mass communicators and receivers. "Dominant model" was prevalent in conventional science popularization, which was one way communication, from communicators to receivers with little feedback. "Equilibrium model" saw communication process was bidirectional—information was not only flow from communicators to receivers, but also the opposite direction. "Equilibrium model" was developed to meet today's communication value which promote "equality" and "interaction".

In China, science and technology museums was a large group, besides China Science and Technology Museum (CSTM), nearly each province has its own science and technology museum. They were featured as the primary force in mass science popularization and technology diffusion. However, for a long time, even today, most of the museums took "Dominant model" as their main communication method. Reflecting on the current situation, China Science and Technology Museum has explored "Equilibrium model" to upgrade its communication method, to construct a scientific community.

Main efforts included:

a. Interactive exhibition. In addition to increase participation in interactive exhibitions, CSTM took use of different channels and methods to balance the relationship between communicators and receivers. Before hold a new exhibition, CSTM do a large scale investigation to collect audience's ideas and demands, which give audience a way to express their science popularization needs, and also a guide exhibition design. During the exhibition, there will be several facilitators, they can have a face to face communication with audience. CSTM also use Radio Frequency Identification(RFID) to track audience, measure their preferences. And there is a timely evaluation after the exhibition.

b. Digital museum and network. China Digital Science and Technology Museum (CDSTM) took use of digital technology, put exhibition, education activities and science knowledge on the internet, people are easily to click and participate. There also was an internet forum, people can exchange ideas and make suggestions freely. With the help of internet, CSTM built a network with local museum and many international museum, which give users a much broader show.

c. Participatory science laboratory (PSL) is a platform for the public to participate the science research process. CSTM has built four PSL, each one will invite scientists to guide the public do the science research. The public can discuss with scientists, give suggestion to improve the experimental procedure and gain knowledge and information during the participatory process.

d. Scientists forum. From year 2010, CSTM invite famous scientists to give lecture in term of current hot

science issues. The public can have a face to face discussion with these scientists and exchange ideas.

These are examples of efforts that CSTM has done to improve the effectiveness of science communication, which can be simply described in the following figure:

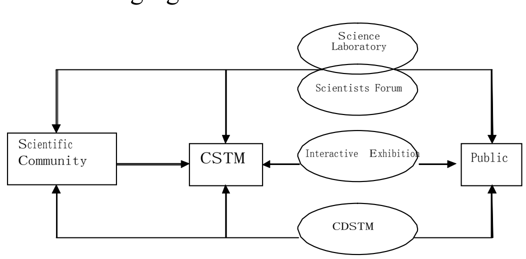

Figure 4:"Equilibrium model" of CSTM

Keywords: Science communication, Equilibrium model, Science and technology museum

86. Science Communication Through Radio

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Abstract. By Communication of information about science and technology is essential for social and economic development. The media is often assumed as an efficient and effective means of disseminating information about various fields including science. Science communication is the key to the scientific knowledge, by virtue of which scientific knowledge and concepts can be carried to the common people. Thus, the common people are benefited with the new advancements in science and technology, and are able to fight hunger, drought, disease, and social evils such as superstitions, with self-confidence, courage and faith. Science communicators usually communicate to non-scientific audience. Communicating science to the public comprises diverse approaches such as public talks, debates, exhibitions, publications, science theatre and television documentaries. Often, these activities form a part of a wider campaign to engage people in science. In recent years, the volumes of scientific information and news have grown rapidly, but the coverage in the media has not grown that exponentially. There is a need to analyze the coverage given to science news / information in Indian media with special emphasis on radio. Now that radio has got revival, it has gained speed of conveying information which no other medium has. The news broadcast on radio has a style and pattern of its own which is quite different from a report in the press. Radio can put across ‘hot’ news to create awareness, though awareness to action calls for an integrated approach to development. Of late, people are particularly interested in health and environment, and this has been reflected through increased coverage. The scope for specializing in environment communication and health communication is increasing. The radio of diverse nature–be it All India Radio, campus community radio, NGO community radio, and educational radio such as Gyan Vani makes efforts in imparting and understanding scientific temper. The paper looks into various possibilities of communicating science effectively through radio, particularly in terms of updating the people with the latest in science and technology. While, radio concentrates on broadcasting phone-in programmes, talk-shows, drama, discussions, symposiums, and debates on subjects of social interest, health, developmental activities and civic consciousness. The paper discusses the various modes of communication by the use of radio. Jayaprakash D. is a PhD Research in the Department of Media Sciences, Anna University Chennai, Tamil Nadu, India.

Keywords: Scientific temper, Scientoon, Campus community radio, NGO radio

87. Preaching to the Converted? An Analysis of the UK Public for Space Exploration

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Abstract. This article presents the results of a survey carried out at two space outreach events in the UK with the aim of characterizing the “public for space exploration”. The survey involved 744 respondents who were asked through a self-administered questionnaire about their belief in extraterrestrial life, rationales for exploration, space policy preferences, attitudes towards space exploration and socio-demographic factors such as gender and age. The public for space exploration was mainly adults between 25-45 years old, and men were slightly more represented than women. The analysis of the relationships between the variables analysed showed that, despite general support for space exploration and particularly for human space missions among respondents, males appeared to be stronger supporters than females, i.e. males had a more positive attitude towards space exploration and stronger political preferences for higher government spending and more ‘complex’ means of exploration such as human space missions. Because mixed groups tend to come together to such events we argue that male respondents would be more likely to be part of the “attentive’ interested” public who come to outreach activities and bring a less interested public with them. Outreach activities by more than mass mediated communication have the chance to engage a less attentive/interested public.

88. Art and Science: A Powerful Partnership for Climate Change Communication

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Abstract. In its apocalyptic scale and emotionally charged urgency, climate change is like no other issue in science communication. Climate scientists hold knowledge about the fate of life on earth. And those who have studied the science in detail and written books must sometimes have been overwhelmed. For example, in writing 'the future of biodiversity and civilisation hangs on our actions' (Tim Flannery 2005), and 'there is almost no time left to act' (James Lovelock 2006), scientists are revealing the unbearable reality that lies in the unemotional graphs and statistics that are the tools of their trade.

Apart from the unacknowledged emotional burden the scientists bear for humanity, an honest emotional response to the significance of their assessments is rarely publicly discussed and hardly ever mentioned in communications from political and business circles. In relation to climate change, it is difficult to find examples of the axiom that communicators must 'talk with' rather than 'talk to' people about science, although this has been a well-accepted conclusion of the UK Government's report on Science and Society, and the White Paper on science innovation policy for the 21st century, which stated:

'... science is too important to be left only to scientists. … When science raises profound ethical and social issues, the whole of society needs to take part in the debate.'

The likelihood that artistic vehicles would help carry emotion and unblock the way towards emotionally mature, wise actions by policy makers has been explored in poetry, music and drama by the Canberra group A Chorus of Women in many presentations since 2007. These original presentations have drawn on the work of the Australian poet and environmentalist Judith Wright, Australian sculptor Tom Bass and the Greek playwright Aeschylus (480 BC).

This paper describes the philosophical, artistic and emotional underpinning of two of these presentations, and provides insights from the facilitated discussions between scientists and nonscientists that have followed the performances.

89. Indian Media Coverage of Climate Change: A Study

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Abstract. Global climate change may be the greatest environmental risk of our time, and of all time. It has the potential to affect all of the Earth's inhabitants, like previous climate change has, but perhaps in a shorter time-frame and on a larger scale. It could alter life as we know it in many arcane, unpredictable ways (Wilson, 1995). Reporting on climate change must address the deeper social and economic dimensions of sustainable development. Reporting needs to be multi-faceted, given the complexity of the issue. Climate change demands both political and personal responses, and this will depend on timely, accurate information. The fact that the reality of today is mediated mostly by the media means the media is the tool to make people informed citizens.

Journalists were more likely to exaggerate rather than reduce measurements. For example, journalists were more likely to exaggerate and not underestimate the rise of sea-levels. The emphasis on bad news, on the potential of horrific events happening, is more newsworthy than information discussing potential subtleties over a longer period. The theory is often used to demonstrate the power of the media over audiences. Agenda-setting studies have suggested that media coverage does influence public attention to climate change, but what to think with regard to the issue is determined by social activism and experience with ground reality.

The methodology of the study is: discourse analysis with the media text including those of The Hindu, The Times of India, The New Indian Express, Deccan Chronicle, NDTV and CNN-IBN; and interview with 25 journalists covering climate change and working in the abovementioned media organizations. The study also involved interviewing some environmental journalists in Chennai. Based on the interviews and review of literature, the following points were arrived at:

- Climate change is abstract, not connected with day-to-day reality;
- Climate change is too broad a topic;
- Climate change is mostly a technical matter;
- Journalists ignore climate change as part of news coverage as they do not understand the technicalities involved.
- Scientists do not give climate change literature in a jargon-free language;
- Journalists hardly receive in-service training on climate change;
- Journalists fail to link ground realities with existing policies and politics.

A discourse analysis of media text proves that journalists have been quite successful in communicating the enormity of the risk planet earth is facing due to climate change. The media makes it clear that problems faced are due to human causes rather than natural causes. The problems faced by climate change journalists are similar to those in other beats. Lack of sensational content may cause reports to get sidelined. So, controversies such as an error in assessing melting of glaciers in the Himalayas are blown up. The fact the Himalayan glaciers are a little explored area complicates the matter. It is difficult to find sources and one cannot get concrete facts. With extensive competition from other media organizations covering the same news story, the media has taken up to approach the story from different angles to retain the news hungry public. Lack of local scientific data and scientific measurement methods too poses a problem.

90. Medical Science Communication Emerging Challenges–A Study

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Background

The rapid transition in the medical and health sciences and technologies over the last 50 years towards a molecular understanding of human body in health and disease and the rise of a host of molecular and digital technologies for investigating and intervening with the body is still largely not available for practical application

The contemporary transition in medical and health science and technology towards molecularization, miniaturization, mediated visualization, digitalization and intangibilization is a major challenge. Current molecular biological research is very dependent upon visualisation methods, both in the production of interpreted data and in the communication to other scientists and the public at large. In this background an attempt is made to study the significance of medical communication on HIV/AIDS.

Methods

In a pilot research, 300 science degree students of different colleges studied about the level of understanding of medical science communication from Jan–2008 to Dec–2009. AIDS health education sessions / contact programmes were organised for different colleges in Andhra Pradesh in batches viz., Batch–A, Batch–B, Batch–C, Batch–D, Batch–E, Batch–F. Each Batch has 50 students

A pre-tested questionnaire was given to all participants before the session on HIV/AIDS–causes–prevention and treatment subsequently after the session a questionnaire is given to all those participants.

Results

The awareness of AIDS among Batch-A was 29%, Batch–B 13%, Batch–C 43%, Batch–D 39%, Batch–E 49%, Batch–F 56%, before participating in the AIDS health education session. Whereas the awareness has gone up to 59% among Batch–A, 39% in Batch–B, 81% in Batch–C, 69% in Batch–D, 63% in Batch–E and 89% in Batch–F after participating in the session. Using a Chi-squared Test, the impact of AIDS health education was found statistically significant among the studied college students viz., Batch–A, ($P<0.001$) Batch–B ($P<0.005$) Batch–C ($P<0.001$), Batch–D ($P<0.005$), Batch–E ($P<0.02$) and Batch–F ($P<0.005$).

Summary

Basing on the session, it is recommended to develop research-based science communication practices for a variety of audiences–spanning from health professionals to the general public–in the form of exhibitions and web products, and with special attention to the aesthetics of science communication. People interested in medical science communication are well advised to broaden their vision to other domains of science communication studies and practices. There is much to be learned from science communication studies dealing with a wide array of sciences through a variety of media.

When 400 senior European life scientists were asked which complementary skills they would have liked to receive training in earlier in their career, 37% and 33% mentioned public communication and peer-to-peer communication, whereas only 17% and 11% mentioned research ethics and bioethics: On analysis the answers given by the college students on medical science communication before attending the session and after attending the session, there is a significant improvement in understanding the various aspects of 'HIV/AIDS'.

91. Science Communication in the Context of Scientific Literacy: A Case Study of Bangalore Science Forum, Bangalore

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Abstract. The present day society and human life is interwoven with scientific and technological advancements. We are living in the age of car, TV, internet, Wifi, 3G, MRI, IVF, Robotics, nanotechnology, MEMS and many more. All these gadgets, concepts have entered into our everyday life. In order to live in such a society and to lead a meaningful life, this kind of situation demands that we acquire a basic minimum of information and knowledge of the nature of science and technology in terms of what is called as Scientific Literacy. Such literacy while being complementary to overall literacy enables us to critically appreciate the interlinks between science, technology and society. Now one of the most of important means of acquiring such literacy is Science Communication. It is well recognized that Communication is the essence of science in all its aspects, be it technical or non-technical. In addition
, it is important to recognize that to the extent that science is a public enterprise, the institutional dimensions of science communication are of great importance.

In the light of the significance attached to communication we intend to discuss the meaning, scope and necessity of science communication in context of Scientific Literacy. After presenting certain preliminary observations concerning the nature of science communication we will present a description of the activities of The Bangalore Science Forum with a view to indicate the institutional dimension of the process of science communication. Following this we will suggest ways in which institutional aspects can be combined with other aspects of communication network to make the spread of scientific literacy a comprehensive domain accessible to a wide audience.

Science Communication generally refers to person/media aiming to talk about science with non scientists and scientifically literates also. It is some times done by professional scientists but has evolved into a professional field in its own right. When science is communicated rightfully it should have purpose and impact on the community to whom it is addressed. The purpose is to obviously make the community scientifically literate and impart is felt if the community absorbs and interacts in society.

At this junction we would like to know about what is meant by Scientific Literacy? According to National Centre for Education Statistics, scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participating in civic and cultural affairs and economics productivity. It also includes specific types of abilities. A scientifically literate citizen should be able to evaluate the quality of scientific information on the basis of its source and methods used to generate it.

In the above context of scientific literacy with specific reference to India we would like to discuss the activities of Bangalore Science Forum with a view to indicate the institutional dimension of the process of communication. The Bangalore Science Forum was Established in 1962, it is about to complete its Golden Jubilee in two years. The Forum conducts, weekly lectures (about 2300 completed), summer school and lecture competitions for the past four decade consistently.

Recently this Forum is conducting science lecture competitions in vernacular for undergraduate students. It has conducted science model making for higher secondary students. This year the forum is conducting a Laser Fest in the month of October. Obviously for the selfless services rendered to society on a voluntary basis, the forum has been awarded two National Awards for Science Communication. In our Paper we will be analytically examining the activities of the forum. Finally, it is our argument that the scope and significance of scientific Communication is best understood in terms of relationship between the process, the institutional frame work and well motivated public participation.

92. How to Communicate a Micro Propagation Technology?

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Abstract. Micro propagation industry is a profitable option. It suits India as it is labor intensive, environment friendly and promises to improve agri-horti and forestry sector productivities. Further, Agro climatic diversity in India, trained personnel, tissue culture research pool huge unexplored domestic markets, off shore markets because of price competitiveness on account of cheap labor make it a potential foreign exchange earner. The micro propagation industry in the country is under performing in this country primarily due to certain grey areas in communication between Research and Industry, financial considerations for technology sustainability, lack of popularization and reluctant acceptance of the Technology. There had been problems during executing transfers, such as variation in results from the claims in the hands of the industry and difficulties in setting up of the production processes based on the lab protocols provided by the institutes. The poor in-house R&D capacities in micro propagation industries in India necessitate complete description of technology including complete scientific data, information, know-how for the manufacture of the product and the component etc. Further, the process of commercialization should go through conceptualization, basic work, applied research, pilot demonstration and commercialization.

The present work reports how to communicate micro propagation technology successfully through proper communication. The case study was performed with a bamboo micro propagation technology developed by Arya et al. (1996). The technology was extended to micro propagation facility of Sheel Biotech Ltd. Gurgaon in three different ways and the performance of the production process was evaluated. One time technology transfer by providing published literature and starter cultures led to an effective shoot multiplication rate of 4 times, a rooting efficiency of 60%, a post rooting survival of 20% and poor growth of plantlets. Demonstration and a short training at technology developer's institution i.e. at FRI Dehradun besides providing published literature and starter cultures improved the overall protocol performance with an effective shoot multiplication rate of 5 times, a rooting efficiency of 72%, a post rooting survival of 68% and average growth of plantlets. Performing all the steps of micro propagation in the production set up where the technology is to be used led to most efficient performance of the technology with an effective shoot multiplication rate of 6 times, a rooting efficiency of 95%, a post rooting survival of 98% and excellent growth of plantlets.

The work concluded that several factors pertaining to species taken for micro propagation, the production staff and production set up influence the performance of a micro propagation protocol. Fine tuning protocol parameters at the end users place besides training of production personnel at the production set up is necessary for rapid and successful technology transfer process.

93. A Model Research on Public Channels for S&T Information in China

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Abstract. Channels and ways through which Chinese citizens obtain science and technology information are one important part of promoting Chinese civic scientific literacy level. They are also a very important part of the Chinese civic scientific literacy survey, which concludes public media channels, public utilization of science popularization facilities such as Science and Technology Museums and public engagement in science popularization activities. In this paper, a research on public channels on S&T was conducted based on previous surveys data. The objectives of this paper were to comb out the categories of public channels and the changes of utilizing proportion, to probe the relationship between public channels for S&T information and civic scientific literacy, and to sort out the characteristics and variation trends of public channels for S&T information among Chinese citizens. Through the analysis on the 8th civic scientific literacy survey data in 2010, models of public channels for S&T information in each provincial units in mainland China were obtained. Regional evaluation was carried out in different areas based on various characteristics of public channels for different groups of people. Regional division on Chinese civic scientific literacy was conducted according to those models. This has important practical significance for conducting Chinese civic scientific literacy construction work differentially.

Keywords: Information channels, Science popularization, Scientific literacy

Introduction

The investigation on pubic channels to get S&T information is a crucial part of the survey on Chinese pubic science literacy. For with the rapid development of Chinese economy and the increasingly improvement of education and science popularization in China today, the development of communication medias such as movie, television, newspaper, journal, book and internet are playing more and more vital roles on the knowledge enhancing and the science information getting in Chinese public. Meanwhile, the science popularization facilities such as S&T museum, arboretum and zoo, and science popularization activities and skill trainings held by national and local institutes become the ways for public to obtain S&T information as well. Furthermore, due to the influence of culture factors, the interpersonal communication also does some works to promote the circling of S&T information. Based on all previous surveys of public science literacy in China since 2005, this paper gives an analysis on the channels and ways for Chinese public to attain S&T information, in order to know how Chinese people obtain S&T information, understand the laws underlying it, and provide suggestions and grounds for Chinese government to make relevant policies.

Television and newspaper are the main channels for Chinese public to get S&T information

The survey results in 2010 show that television and newspaper are the main source of S&T information for Chinese public with the proportion being 87.5% and 59.1%. We can see from table 1 that the percent of respondents selecting television and newspaper as S&T information source are high in all these surveys.

Table 1 The source of S&T information for Chinese public (%)

	2005	2007	2010
1.Newspaper(N)	44.9	60.2	59.1
2.Book(B)	10.2	11.9	11.9
3.Radio(R)	22.4	20.6	24.6
4.Television(T)	91.0	90.2	87.5
5.Science journal(Sj)	9.5	13.2	10.5
6.Internet(I)	7.4	10.7	26.6

7.Personal communication(P)	48.7	34.7	43.0

The proportion of other channels remains stable except the considerable raise in internet. The percent of public naming electric media as the source of S&T information has been increasing (7.4% in 2005 and 26.6% in 2010). This is consistent with the trend of internet development in China. The rapid expansion of economic and social development in China widened the channels for Chinese citizens to get science & technology information. Moreover, it is important to note that, due to the undeveloped communication facility and traffic infrastructure in China, public in main districts depended largely on personal communication as the main source of S&T information. The data of 2010 showed that 43 percent of the public reported communication with relatives and colleagues as their S&T information source, being distinctly higher than 20.2 percent of 2001 and 28.5 percent of 2005. As to this phenomenon, we think that it is just the influence of culture factors and economy development that makes personal communication the main source for Chinese public to obtain S&T information.

The opportunities that Chinese public use science popularization facilities gradually raised

In 2010, the proportions of public who visited science popularization venues are 57.9% for zoos, aquarium and arboretum, 27.0% for S&T venues such as science and technology museum, 21.9% for museum of natural history. The proportions of respondents who visited cultural and art venues are 50.3% for public library and 26.4% for art gallery or exhibition museum. The proportions of public who visited sites for popular science are 54.5% for reading room, 48.7% for science popularization gallery or publicity column. The proportions of citizens who visited professional technology venues are 35.5% for science and technology demonstration site or science popularization activity station, 34.2% for industry and agriculture industrial park, and 11.2% for universities and research institutes laboratory. Comparing with the situation in 2005, the proportion of citizens who have visited sites for popular science saliently increased. The proportion of the reason ‘Not in local’ for not visiting those facilities for popular science decreased over the years. Take the situation of visiting science and technology venues as an example, the proportion of respondents who visited those venues is 27.0% in 2010, which raised 17.7% comparing with 9.3% for 2005. The proportion of public who didn’t visit these venues because of ‘not in local’ is 37.6% in 2010, which decreased 18.1% comparing with 55.7% for 2005.

The proportion of public who participated in science popularization activities and training increased

The 2010 survey showed that the proportion of public who took part in large-scale mass science popularization activities such as science and technology week, science festival and science popularization day is 23.8%. The proportions of citizens who participated in all sorts of regular science popularization activities are 35.6% for science and technology training, 31.4% for science and technology consultation, 29.4% for popular science lectures, 25.1% for science and technology exhibition and 13.7% for science popularization campaign vehicle. Meanwhile, for science popularization campaign vehicle, though the proportion of participation is low, over 62.8% of respondents indicated that they’ve heard of it.

The Difference Among Different Groups of Public on S&T Information Getting (Based on 2010 Survey)

The difference between different genders of public on S&T information getting

There is little difference between male and female respondents on their channels of knowing the current affairs of which television is the leading source while personal communication and personal communication ranks the second and the third. Male respondents, however, report that they tend to get S&T information from newspaper, magazine and Internet, while female relies more on communication with relatives and friends.

Table2 Information source of respondents with Male and Female

%	N	B	T	I	
P					
Male	64.0	12.5	88.9	28.9	41.4
Female	56.5	11.8	89.8	25.3	46.5

Taking the situation of visiting science and technology venues as an example, the proportion of male citizens who visited these venues because of ‘Self interests’ is higher than that of female citizens, with the numbers being 11.1% and 7.5%. The proportion of female citizens who visited these venues ‘With relatives’ is higher than that of male citizens, with the numbers being 8.1% and 7.3%. From this we can see that male citizens intend to visit science and technology venues more initiatively.

The difference among people with different educational background on S&T information getting

Although television is the main source of S&T information for people with any level of education, the data show that the dependence on television tends to reduce with the increase of educational level: the highly educated people tend to get the S&T information through newspaper, book, magazine/journal, and internet, while the low educated people depend more on the media such as television, personal communication, and radio.

Among the public with low or none education, about 91.2 percent (2010) of the public reported getting S&T information through television, namely television was the main source of S&T information to them, while two continuous surveys showed that both percents of these respondents naming electric network as S&T information resource were low. Compared with other people with different level of education, this group of public intended rather to choose communication with relatives as their way to get S&T information, and the percent of respondents in this group who like to choose radio as information source was higher than that of other groups of respondents. Despite of low or none educated, part of these respondents maintained that they got the information by newspaper as the information source. Information source of respondents with different educational level (%) are shown in Table 3.

Table 3 Information source of respondents with different educational level (%)

	Level of Education	N	B	R	T	I	P
2010	1	17.2	7.9	36.4	91.2	3.7	68.1
	2	42.0	10.2	36.5	93.4	8.5	61.5
	3	63.8	11.9	27.0	91.5	19.0	47.5
	4	71.7	13.9	18.7	87.7	36.3	33.7
	5	73.9	13.6	12.9	12.9	61.9	20.6
	6	71.3	15.2	9.3	9.3	75.5	17.3
2005	1	4.8	4.1	24	84	0.8	59.8
	2	27.3	5.6	24	91.1	0.2	60.3
	3	53.4	11.4	23.2	93.6	4.6	47.4
	4	73.7	17.4	18.4	89.8	20.5	31.4
	5	76	17.1	14	87.9	42.9	20.3
	6	68.4	24.6	14.1	77	55.4	7.4

1=None or low educated; 2=Preliminary school; 3=Junior high school; 4=Senior high school/technical secondary school; 5=Junior college; 6=University and above

One important feature of the group with university and above level of education is that the percent of them naming internet as channel to get S&T information was the highest among all the groups, the number of which is 75.5 in 2010, which increased 10.1% than 2005, being much higher than that of other groups.

Several characters of the relationship between the main channels for China public to get S&T information and their educational level were revealed in these surveys: the percent of respondents naming modern technique as way to get information, including S&T information, was positively related to the educational level, and this trend was salient; the traditional channels such as television, radio personal communication was negatively related to the educational level; ③ the percent of respondents naming book, newspaper and journal was positively related to the educational level.

The difference among different age of pubic on S&T information getting

Analysis of the difference among different age of public on S&T information getting showed that the percent of naming newspaper was the highest among respondents aged from 30 to39 and from 40 to 49 (over 50%). The highest percent of naming book fell on the youngest group, among which 16.7 percent of respondents reported relying on book to get knowledge and information, while the group from age 50 to 59 reported the lowest percent of naming book. The respondent naming radio as the most favor way of getting knowledge was from the age group of 60-69 and the percent of youth naming this way was the lowest. Young people remained the group who liked magazine/ journal most. The percent of public naming magazine/journal was negative related to age: the older the respondent the lower the percent was. Internet as information source was negative related to age: about 59.1 percent of young respondents accessed internet to get information, the percent of group aged from 30 to 39 who named internet was as low as 4, while only 9.4 percent of the respondents older than 60 used internet to get information. Moreover, the percent of respondents naming communication with relative or colleague deserves our attention: the number was high in each level of age group while the percent of group from age 50 to 59 and 60 to 69 were the highest.

Table 4 Information source of respondents with different age (%) (2010)

	18~29	30~39	40~49	50~59	60~69
N	56.3	63.6	63.9	60.6	53.6
B	16.7	12.0	11.5	9.3	9.9
R	19.4	22.3	24.6	30.9	33.0
T	86.0	88.7	90.4	92.0	90.7
I	49.7	34.0	21.5	12.1	8.2
p	33.9	40.3	45.7	50.8	54.7
Others	56.3	63.6	63.9	60.6	53.6

Relationship between age and S&T information source could be seen from the percent of different age groups on reporting the way to get S&T information: ③ the using of modern technology as information source was negatively related to age: the older the respondents the lower the percent of naming radio, television and personal communication as information source; ③ the information source of radio, television and personal communication was negatively related to age.

The difference between urban and rural public on S&T information getting

There were great differences between urban and rural public on their channels of obtaining S&T information. Television being the main source of information, rural public, however, relied more on television than urban citizens to get information (91.6% vs. 86.5%, 2010). Furthermore, the percent of rural public (50.9%) who took communication with relatives and colleagues as S&T information source was higher than that of urban public (34.7%), while the latter had obvious high dependence on newspaper, book, magazine/journal, and Internet. The difference on internet utilizing was especially sharp: the data of 2010 showed that the using rate of internet by rural public (18.0%) was distinctly lower than that of urban citizens (39.2%), and this gap was still great yet decreasing. The increasing degree of internet-using of urban public is higher than that of rural public.

The proportion of rural citizens who didn't visit science and technology venues because of 'Not in local' is 45.3% and that of urban citizens is 28.5%. The rural citizens who occupied most of China's population are lack of opportunities and ability to use modern and convenient methods to get science and technology knowledge and other kinds of information. This is the focus in the civic scientific literacy construction work in China for the future.

The Development Trend of S&T Information Getting

It could be seen from the development trend of S&T information getting of Chinese public that the channels and ways for Chinese public to obtain S&T information has been developing in consistent with the diversified development of Chinese media and other S&T communication methods. The 2010 survey showed that the percent of public using television to get S&T information remained high. Of the newspaper and journal, the percents of public who took them as knowledge source were maintained at about 60 during 10 years since 2000. The percent of public using electric network as information source was increased most quickly: the number of it was only 1.6 in 2001, being increased to 10.7 in 2007 and to 26.6 in 2010.

In 2010, The Twenty-sixth Statistic Report of Internet Development Situation in China issued by China National Network Information Center (CNNIC) showed that, till June, 2010, the total number of internet using citizens in China exceeded 400 million the first time, reaching 420 million and ranking second in the world only after America. The popularizing rate of internet rose to 31.8%. As a new way of information circling, Internet is gradually infiltrating the lives of Chinese people and becoming a more and more popular channel of S&T information communication. The development trend of channels for Chinese public to get S&T information (%) are shown in Fig.1

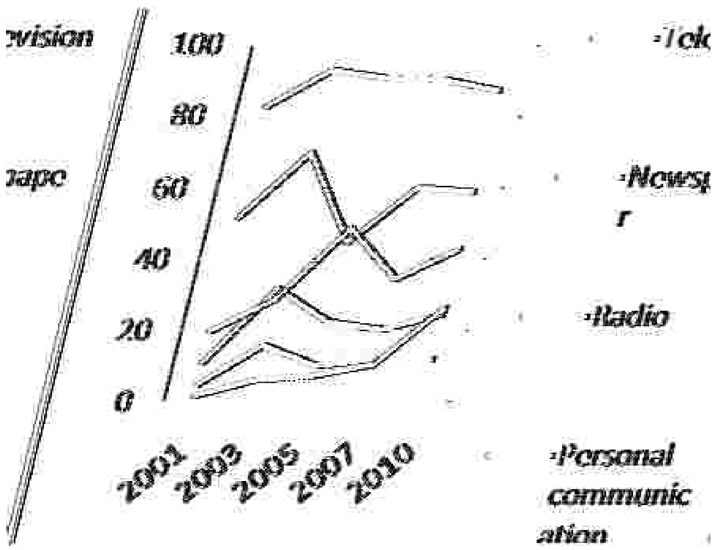

Fig 1. The trend of channels

Conclusion

Conclusion could be drawn from the analysis above that with the development of economy the channels for Chinese public to obtain S&T information become large diversified. Besides, the channels for different social groups to attain S&T information is affected deeply by the factors such as educational level and age: the lower the age and the higher the level of education, the wider the ways to get current affairs and S&T development information and the more frequent of relying on internet; the influence of internet, newspaper and magazine is great among the group with young age and high educational level.

To extend the channels and ways for public to obtain S&T information will have important influence on the improvement of science literacy of public, the high efficiency and effect of these channels could bring more opportunities for public to get S&T information actively or passively and then contribute to the improvement of nationwide public literacy, and the professional skill training will play crucial role in the future, for the percent of public who get knowledge about S&T through professional training is very high, especially in the rural areas.

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94. Making 'Science of Nutrition' 'Food for Thought' and 'Recipe for Development' of Masses through Resourceful Communication

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Abstract. Right nutrition of masses is both an index and outcome of development of a nation. Poverty, as per one of its most basic and poignant definitions, is lack of resources to acquire enough calories for daily nourishing requirements. Further, Nutrition as a science is contemplated as a growing body of systematically arranged facts about the consumption and utilization of food by the people. Nutrition, in an another context, as a process, is considered as the everyday fuelling or supplying the living body with the substances needed for its growth, maintenance and healthy physiological functioning.

Thus mandate for the science of Nutrition as a truly applied science that nurture nourishment, health and longevity could be realized if the basic facts of nutrition as a science are communicated, comprehended and put to use for bettering the nutritional status of individuals resulting in well nourished and healthy masses. However, this is no less arduous task, far easier said than done. For instance the decade old Food and Agricultural Organizations (FAO's) clarion call for 'Getting the Best from your Food' communication wrested on making masses paying heed to their nutrition for staying healthy and fit.

However, the laudable initiative got stymied for want of effective delivery to the targeted masses in many countries including our own. Take another message, for re-emphasis on food safety which calls upon a robust two pronged action: (1) keep hot food hot and cold food cold, (2) When in doubt, throw the food out; has never met with the attention and importance it deserved for communication. Likewise, a message underscoring the role of nutrition in pregnancy and exclusive breast feeding in infancy makes out two causes for oft observed and invariably irreversible mental insufficiency of infants: (1) Mother's malnutrition during pregnancy, (2) Infant's malnutrition during first six months, have never been made to go down well with the masses. NFHS III (2005-06) figures of astronomically high maternal mortality and morbidity in India (MMR–254 vis-a- vis ≤ 10 of developing countries) and abysmally low percentage of exclusive breast feeding. (51% at 2-3 and 28% at 4-5 months of age) stare us straight in the face. Infact, there is a pressing need to beam the exclusive breast feeding till 6 months message to the mothers as well as other household members who often hold views different from this so as to create an enabling environment for change.

Suffice to say, the reason for the emergence of twin India in Indian polity; one poor and the other affluent, with both bearing the brunt of lopsided nutrition as deficiency or excess nourishment has been lack of imaginative communication strategies, awareness generating programs along with poverty alleviation endeavors. For, if a trend in lackadaisical communication of Nutrition science continues unabated, it could well become Food for Heedlessness and Recipe for disaster. Thus it is worthwhile to discuss Nutrition Communication in a bid to make effective, imaginative strategies for it.

95. All Sorts of Job Titles, But What Do You Actually Do? Profiles of Science Communication Professionals

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Abstract. Science communication (SC) professionals are employed in industry, government, businesses, NGOs, research institutes, media and museums. But it is difficult to compare their jobs because their job titles don't give a good indication of what they actually do: there are many different job titles for similar positions, and often professionals with the same title fulfill different tasks, whether or not on a different level.

Therefore, in this workshop we will focus on the tasks SC professionals carry out in their professional life. With science communication professionals from all over the world we would like to discuss and determine what kind of tasks they actually perform and at what specific level. In doing this we will make use of the model of SC professional profiles developed at Delft University of Technology. In addition we would also like to ask the SC professionals what kinds of knowledge and what skills they need to properly perform one of the specified tasks. Another interesting question concerns professional development: what kind of options does a SC professional have to grow?

This workshop provides professionals with a tool to position themselves relative to their colleagues and to reflect on their professional growth. For education developers, the outcomes of the workshop could provide a solid basis for developing refresher courses / post-graduate courses targeted specifically at the needs of the professionals.

96. The Lack of Public Engagement With Nanotechnologies in Finland: The Deficit Model in Praxis

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Abstract. While preceding surveys have shown a high level of trust for science, technology and scientists among the Finnish populace, the recent Eurobarometer for Science and Technology has a different story to tell. Drawing on material gathered through a series of in-depth interviews with leading academics, public officials and other stakeholders involved with nanotech policy in Finland, this study aims to explore the attitudes towards the lack of public engagement with nanotechnologies, in the light of the aforementioned surveys.

The Eurobarometer survey suggests that Finns, though interested in new scientific discoveries and technological developments, consider scientists to foster a 'tunnel vision', concentrating on their individual fields rather than seeing their research in a wider perspective. The survey also shows that 47% of the respondents want the public to be consulted with regards to decision-making related to science and technology. A majority of the interviewees, on the other hand, show little understanding for the need for public engagement as the Finnish public, in their view, is very pro-technology, content with the situation, and generally disinterested in nanotechnology policy.

In conclusion, the paper suggests that the lack of public engagement in Finland is due to the institutionalized cultural circumstances in which Finnish nanotechnology policy and research and development is being carried out, which seem to suggest that Finland could be a textbook example of the deficit model in use.

97. Neuroscientists' Perceptions of Public Representations of Science: A Cross-national Comparison Between Germany and the United States

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Abstract. A topic that has been comparatively neglected in the science communication and science policy research literature is the question how media coverage of science and research can influence science governance processes. Previous research showed that researchers try to use the media to legitimize their research and attract research funding. However, it must be assumed that public expectations about research and especially the representation of such expectations in the media might have an influence on how research is regulated by the state or self-governed by scientific institutions.

Here we assume that scientists and researchers might react to public images of their research in two ways: First, by adapting their actual research practices to an image of research that is desired by the general public. Second is by choosing self-representations that live up to the expectations of the public. Hence, we are interested in examining 'informal' governance aspects of research through various media channels. We have chosen neuroscientific research as a case study. Research in the multidisciplinary field of the neurosciences is particularly interesting for studying governance processes since it is a field where various ethical, social, legal and economic issues and interests collide and, also, because various topics related to the neurosciences have generated a substantial amount of media coverage in the recent years.

In order to be able to investigate informal governance empirically it is important to first get an understanding of how neuroscientists themselves perceive the public image of research and also where they get their information from on science and society. To investigate this matter further we conducted a cross-national online survey in the USA and Germany. We assumed that media usage behavior differs between researchers in the USA and in Germany. 500 Neuroscience researchers from both countries, who had at least two publications in peer-reviewed journals in the field of the neurosciences, were sampled randomly. They were asked how they evaluate the impact of various information channels (e.g. print media, online news, TV and radio programs, blogs) on policy makers. It was also of interest how the neuroscientific researchers perceived the impact of media coverage of science on the general public. Furthermore, neuroscientists were asked about their own use of information channels. Another issue that was considered was the role of blogs and virtual social networks (e.g. facebook, LinkedIn) for the information strategies of neuroscience researchers.

The survey is in the field as the abstracts are reviewed, results are expected for late fall. The results will inform further steps in a comprehensive research project about informal governance aspects of research in Germany and the United States. These include the analysis of formal institutional ways of governing research in the neurosciences in the two countries; a cross-national comparison of media coverage of research in the neurosciences; and also focused interviews with senior neuroscience researchers in order to investigate how the neuroscientific community perceives its media image and the impact media coverage of their research field has on their research and working practices. Similarly, we also want to find out how neuroscientists assess the impact of media coverage of research on science policy makers and the general public.

98. A Proposal for an Intercultural Science Communication Model to Democratize Science

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Abstract. The present paper is part of an ongoing research project that seeks to establish the characteristics needed for the construction of new spaces to democratize science. Originally, we focused the study on 'science gardens', but very soon it became evident the need for the development of a science communication framework. Background literature review on preexisting science communication models indicates two main trends. One trend bases the model on political or ideological grounds, while the other one bases it on cognition patterns, which are common for all human beings. Although cognitive theories, borrowed from psychology or anthropology, are understood to be generally applicable to all humans, they can also be chosen in order to justify a specific ideology underneath a model. Particularly, when people are in the process of forming an opinion, research suggests that it can occur in the absence of relevant scientific or policy-related information (i.e. cognitive miser model). Also, in some instances, these models were only pertinent to the societies where they were first developed for, not general enough to be applicable to other cultural contexts. In order to consider Science Communication as a consolidated discipline, we need to develop general theories and models. We thus propose an 'intercultural science communication model', where culture is mostly understood as a language (symbols with a logical order) and science communication as a process between two ways of expressing knowledge: a technical language of science and an everyday language. In this way, a trans-cultural space is formed enabling researchers and diverse publics to engage in various conversations, exchanges, and interventions. This intercultural exchange is undoubtedly a participative process as it is dialogue among scientist, science communicators and society. Within this approach we refer to the so called dual model for cognitive processes, where two ways of learning and remembering are combined. Often, the two processes consist of an implicit (automatic), unconscious process and an explicit (controlled), conscious process. We will describe our proposed model and provide examples on its applicability.

99. The Craft of Effective Science Communication: Methods, Practices and Models

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Abstract. Science Communication is both science and art. The ability of a good science communicator depends on how efficiently and effectively s/he crafts the message of science in an artistically appealing and impressive way while retaining the scientific accuracy and authenticity in the message communicated. The proposal of this paper is to offer an insight of the various methods, practices, principles and models of effective science communication. It is proposed to discuss and critical review the strengths and limitations of the various existing models of science communication. The author will also present his techniques and practical advice as the craft of effective science communication. An intrinsic model of effective science communication is also proposed here.

Keywords: Effective science communication, Methods, Models of science communication, Intrinsic model of effective science communication

100. Making 'Science of Nutrition' 'Food for Thought' and 'Recipe for Development' of Masses through Resourceful Communication

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101. Pioneering Science Communication Endeavours of Tamilnadu Science and Technology Centre

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Abstract. Science Centres are influential in providing education on modern science and new technologies. Tamilnadu science and Technology Centre works with a keen view to build an effective and democratic Indian Knowledge society, and with the aim to stimulate the harmonious integration of scientific and technological endeavour in the Indian social web. Mahatma Gandhi enumerates seven deadly sins. One of them is Science without Humanity. He says “If science becomes all technique and technology, it quickly degenerates into man against humanity. Technologies come from the paradigms of science. And if there's very little understanding of the higher human purposes that the technology is striving to serve, we become victims of our own technocracy. We see otherwise highly educated people climbing the scientific ladder of success, even though it's often missing the rung called humanity and leaning against the wrong wall. The majority of the scientists who ever lived or living today, and they have brought about a scientific and technological explosion in the world. But if all they do is superimpose technology on the same old problems, nothing basic changes .We may see an evolution, an occasional "revolution" in science, but without humanity we see precious little real human advancement. All the old inequities and injustices are still with us. About the only thing that hasn't evolved are these natural laws and principles - the true north on the compass. Science and technology have changed the face of most everything else. But the fundamental things still apply, as time goes by. “

Science matters to every single one of us. It affects our everyday lives in thousands of different ways, and the scientific advances of today will shape how our lives change in the future.

The popularization of science and technology is intended to provide broad sectors of the population with the challenge and satisfaction of understanding the universe in which we live and, above all, being able to imagine and build possible new worlds'.

Today there are societies that progress, build and create, and others that passively contemplate such progress, with little chance of understanding and adapting to the changes that progress implies. One of the major challenges facing developing countries is to make science and technology an essential part of the culture of the people.

At Tamilnadu Science and Technology Centre we realize the need for dissemination of Science and technology knowledge to uplift the society and also several unique methods are being adopted to reach different weak sections of the society.

Planetarium Show for the Hearing Impaired

India is a very populous country so the number of deaf people can not be definitely estimated. It is known to be in the millions. In children, hearing loss can lead to social isolation. Also the child experiences delayed social development that is in large part tied to delayed language acquisition. In order to bring cheers to the life of such children, and to provide education on astronomy, B. M. Birla Planetarium of Tamilnadu Science and Technology Centre, Chennai has developed a planetarium show exclusively for them.

During the past two years, Tamilnadu Science and Technology Centre organized a good number of ‘spend-a-day-in-science-centre’ programmes especially for the hearing impaired. In these programmes scientific facts were taught with the help of a sign language interpreter. Sign language is a language which uses manual communication, body language and lip patterns instead of sound to convey meaning. In this method by simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions the interpreter expresses the information. The programmes were successful as they were well received by the special audience. This success was an inspiration for us to develop a planetarium programme exclusively for the hearing impaired.

For this programme a simple script was developed and it was interpreted by a sign language interpreter. It was filmed and was projected using a LCD projector in a corner of the planetarium dome. After the presentation of each small paragraphs of the script, the appropriate animation or picture or constellation or celestial navigation or special effect presentation were shown. The following were the considerations for the development of this show.

1. Simple and straight-forward script; in normal scripts we use ornamental words; here the content is short and

time is more–to enable them to view the pictures as well as interpreter's sign language

2. Application Oriented; Celestial Navigation, seasons, reason for seasons etc.

3. Illustration Rich; the pictures were provided with texts and pointers. Hearing-impaired children score significantly below norms for hearing children on language and reading measures. However, some of them who became hearing impaired at later stages can read text messages easily. The first programme thus developed was given the title 'Sun and Planets' and was inaugurated in the morning

of 12th June 2008 at B. M. Birla Planetarium Tamilnadu Science and Technology Centre, Chennai. To the programme children from several schools for the hearing impaired were invited. The students gathered were for at least three jam-packed shows at the sky-theatre. Some of the Special Schools have sections for vision impaired students. To the vision impaired students who attended this programme the script in Braille was circulated to enable them to know the content in advance.

After the inauguration, at least, once in a week a special show is being organized for the special children. The information about this noble task by the planetarium prompted several institutions to celebrate the Helen Keller Day on June 27th at the planetarium. On that day several shows from the early morning were arranged for the hearing Impaired.

Science Programmes for the Disabled

For the past five years Tamilnadu Science and Technology Centre is organising spend-a-day in science centre programme for the Hearing Impaired persons. A few sign language interpreters are being invited to accompany the students during the programmes. For the past two years, the Centre started organising such programmes periodically for the dyslexia students, mentally retarded, physically challenged and visually impaired. For the visually impaired, the planetarium programmes are being distributed in Braille language. Every gallery has a write-up in Braille explaining the content of the science gallery.

Programmes for Women

The development of our society largely depends on its capacity to create, exploit and disseminate knowledge and, from there, to continuously innovate. Scientific researches by men and women plays a major role in this regard, and should continue being one of the driving forces in promoting growth, welfare and sustainable development. The roles that men and women play in society are not biologically determined; they are socially determined. The roles of women are changing. These roles vary widely by locality and change over time. Science and technology have been an integral part of Indian civilization and culture. Women and men have been active in science from the inception of human civilization. However, due to deprivation of privacy and time to think, the percentage of Women Scientists in our country was very low. Presently, the trend is reversing and we find more women scientists now.

According to a study by United Nation's Population Fund (UNPF) about two thirds of the illiterate adults in the world are female. Higher levels of women's education are strongly associated with both lower infant mortality and lower fertility, as well as with higher levels of education and economic opportunity for their children. Education is one of the most important means of empowering women with the knowledge, skills and self-confidence necessary to participate fully in the development process. In fact, women require good training in ever advancing technological innovations. Realizing the significance of women's education in the fields of technology, Tamilnadu Science and Technology Centre is ceaselessly engaged in science communication activities exclusively meant for women empowerment.

Science Popularization

The popularization of science and technology is intended to provide broad sectors of the population with the challenge and satisfaction of understanding the universe in which we live and, above all, being able to imagine and build possible new worlds'. Today there are societies that progress, build and create, and others that passively contemplate such progress, with little chance of understanding and adapting to the changes that progress implies. One of the major challenges facing our nation is to make science and technology an essential part of the culture of men and women equally.

At Tamilnadu Science and Technology Centre we realize the need for dissemination of Science and technology knowledge to uplift the society and also several unique methods are being adopted to reach women and girl children.

Special Programmes for the Self Help Group (SHG) women

In the state of Tamilnadu Women Self Help groups are very active and are helpful to the society in many ways. SHG is group of rural poor women who have volunteered to organise themselves into a group for eradication of poverty of the members. The members of the group use this common fund and such other funds that they may receive as a group through a common management. The financial condition of the individual members safely improves generally with that of the group. Further, being a member gives them a secure feeling and enables them to gain knowledge, education and wider outlook. Tamilnadu Science and Technology Centre organize exclusive programmes to them in order to train them in various skills. To communicate the modern technologies to augment the skills of women SHGs, Computer training Programmes, Training on Vermi-composting, farming techniques to enhance the productivity, lectures on health and hygiene are being organized. SHG is group of rural poor women who have volunteered to organise themselves into a group for eradication of poverty of the members. The members of the group use this common fund and such other funds that they may receive as a group through a common management. The financial condition of the individual members safely improves generally with that of the group. Further, being a member gives them a secure feeling and enables them to gain knowledge, education and wider outlook. There are over 21,000 SHG in Tamilnadu. The training provided at Tamilnadu Science and Technology Centre helps them to enhance their income and also help them to lead healthier lifestyle. Similar Programmes are also being organised at Tamilnadu Science and Technology Centre for the homemakers periodically, which enables them to earn extra income for the family and have healthier life. Professionals from various research institutions like M S Swaminathan Research Foundation (MSSRF), IIT-Madras, CPR Environmental Foundation, etc and Experts from leading farms used to interact with the participants.

Programmes for the Home Makers

The development of the country depends on the attitude and the activities of the women who look after the needs of the every member of the family. Children spend long times intimately with the mother in the home. If the mother is empowered with scientific awareness then the children also will have brighter knowledge. According to Psychological studies environment plays an important role. Tamilnadu Science and Technology Centre organizes Programmes for the Homemakers periodically. By way of doing so, they are being provided with methods of earning money also. The waste management methods, producing bio-compost, vermiculture, home gardening etc are also being taught.

Programmes for the family-groups

The knowledge development of a child will normally be closely monitored by their relatives. The parents and grand parents know the behaviour and the knowledge level of the child in the residence. However, their performance in a group and in their school and the comparison with their peer groups will largely be unknown to them. The family science learning programme gives the family an opportunity to understand the standard of the children and enables them to effect ways to improve. Whole-day programmes are being devised with combination of subjects and Psychological evaluation of the students by a professional Psychologist.

Programmes for the Self-Help Groups and Village Heads

In the state of Tamilnadu Women Self Help groups are very active and are helpful to the society in many ways. Tamilnadu Science and Technology Centre organises exclusive programmes to them in order to train them in various skills. In addition, the village heads are important channels to transfer the government grants and the important announcements and the messages intended for the farming community. While organising the programmes for the Village heads we have seen the enthusiasm and the motivation among them to help the people of their region. Professionals from various research institutions like MS Swaminathan Research Foundation (MSSRF), IIT-Madras, CPR Environmental Foundation, etc and Experts from leading farms used to interact with the participants.

Programmes for the Students in the Rural Parts of the State

Outreach Programmes

In order to disseminate the information of Science and Technology among the general public and students community in particular, the Tamilnadu Science and Technology Centre has been extending good educational services through conducting various year round extension activities besides the permanent educational facilities like Planetarium, Halls of Science and Science Parks, established at Chennai and Tiruchirappalli. The following activities are conducted periodically, every year for the past several years.

Science Demonstration Lectures

Every week, on Saturdays, Science Demonstrations are conducted to supplement formal science education in Schools / Polytechnics. A good number of students attend this programme, in which using low cost innovative teaching aids science concepts are taught. The gadgets like nail bed, Liquid Nitrogen experiments, experiments on electricity, magnetism, sound, etc were developed and are being demonstrated free of cost.

Science Fairs

Science Fairs for the school students are conducted at least twice a year to stimulate ingenuity and encourage experimentation towards purposeful innovations. In this science competitions are also involved. These programmes are organised at various parts of the state.

Science Seminars

Seminars are conducted periodically for the School / Polytechnic / College students on the subjects of current interest.

Teacher Training Programmes to Focus on Science Activities

This programme is conducted mainly to train and motivate the teachers for the stimulation of science activities among students.

Under this programme schools from all over Tamilnadu are invited and guidance and work facilities are provided to induce scientific inquiry leading to experimentation and innovations to direct the abilities of students towards materialization of their ingenuity.

Film Shows

Educational Films are screened on different areas of Science, Technology and Culture as regular features.

Health and Family Welfare Exhibition

As a part of Women's Education Policy, these exhibitions find immense use particularly to the rural sector.

Meet the Scientist Programmes

This is a very popular programme among the students of this region. Scientists and Technologists are invited to share their knowledge in view to improve the focus and the attitude of the school children towards education, science and technology. Yearly, at least, 40 Meet the Scientist programmes are conducted at Periyar Science and Technology Centre, Chennai and Anna Science Centre, Tiruchirappalli.

Meet the Medical Expert Programmes

To enable the student community to learn about the recent developments in the Medical field and also to motivate them leading Medical Experts are invited every moth on last Friday to interact with the students on various topics, such as, diabetology, E.N.T., Opthalmology, Cardialogy, Urology, etc., The experts perform basic medical scanning to the interested participants on-the-spot.

Mobile Science Exhibition

To popularise science and technology themes to the general public, especially for the school children in the rural areas of Tamilnadu, the Mobile Science Exhibition with 24 built-in participatory type of exhibits, based on the various themes of science such as sound and hearing, sensation, perception, vision and illusions, has been in continuous operation since January 1990. Mini-Planetarium programmes are also conducted along with Mobile Science Exhibition wherever facilities are made available. Science Video Programmes are regularly screened in the evening hours during the programme periods. Over 16 lakh persons have participated in the Mobile Science Exhibition programmes. During vacations, the Mobile Science Exhibition is conducted at the places of public gatherings like Arignar Anna Zoological Park, Vandaloor, Government Museum, Egmore etc.

Setting up of Science Parks

In order to give impetus to the process of popularisation of science and technology among the students community and general public in the rural areas, the Periyar Science and Technology Centre has taken up the task of setting up of Science Parks in schools and in the different district headquarters.

Topical Programmes

Appropriate Scientific programmes are being chalked out to disseminate information to the student community and to the general public during special periods such as the Year of Scientific Awareness, International Year of the Earth, International Year of Astronomy, etc.

Temporary Science Exhibitions

The Centre participates in the All India Tourist and Industrial Trade Fair, being organised by the Tamilnadu Tourism Development Corporation at Island Grounds, every year and conducts the Science Exhibition displaying 50 exhibits in a separate pavilion of area 60' x 40'.

Science Programmes with Foreign Scientists

In coordination with the British Council, Chennai, Periyar Science and Technology Centre is organising lecture programmes by UK scientists and Science Fairs for School students every year.

In coordination with Alliance Francaise, Chennai, Periyar Science and Technology Centre is organising French Science Today programmes in which Scientists of various fields from France visit our Centre to deliver lectures on French Science Activities and new developments to the students.

Every year on the Cosmonautics day and on Valentina Tereskova's Birth Anniversary, special programmes such as quiz competitions, lectures and temporary picture exhibitions are arranged at Periyar Science and Technology Centre in collaboration with the Russian Cultural Centre, Chennai.

With the U.S. Consulate, Chennai the Centre conducts Science Lectures by NASA Scientists and Scientists from various other fields. Lecture by Mars Exploration Rover Mission Scientists, was conducted recently in coordination with them.

With IDP-Australia, Chennai, teacher training programmes are organised periodically, in which teachers are taught about creating simple gadgets to demonstrate science concepts to the students.

Science Popularization Through Mass Media

Our country has people with deep rooted unscientific faiths on celestial events. The generations to come should be relieved from the clutches of such unreasonable thoughts. Bearing this in mind Tamilnadu Science and Technology Centre is constantly engaged in spreading the information on celestial events, topical issues and general information through mass media. Activities aimed at the popularization of science and technology point in various directions, from the distribution of information in the mass media to formal education. A programme concerned with popularizing science and technology through mass media is easier to achieve than educational reforms, and could certainly lead more efficiently and rapidly to a more positive social attitude towards science and technology.

Conclusion

A number of historical, cultural, political, social and economic situations have given rise to the need to develop strategies that favour the popularization of science and technology in developing countries. The popularization of science and technology must make such knowledge a central component of culture, of social awareness and of collective intelligence. It must also contribute to an effective integration of cultural, ethnic, linguistic, social and economic issues. The technical possibilities of gaining access to information are changing our vision of the world and transforming the relationship between human beings and the appropriation and dissemination of knowledge. Today, access to knowledge is synonymous with development, well-being and quality of life; in this context, scientific and technological literacy is a social and ethical right of all human beings. Tamilnadu Science and Technology Centre is incessantly engaged in activities to empower the society with scientific knowledge.

102. Science Communication Education in North East India

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Abstract. More than half of the Indian population stays in rural areas and therefore connecting the unconnected becomes one of the primary challenges. Science and technology development and the general people's awareness are necessary for overall society development. No one can doubt the immense impact of science and technology on society today. We face the challenges of not only understanding the current multiple revolutions in science and technology, but also how they affect the future of humanity and of the Earth. So scientific information, scientific thoughts and spirit of scientific temper need to be spread across the society. Science communication can be referred to the flow of scientific information and message from its source to target audience, through some medium or mediator. Except a few very honourable exceptions, generally, scientists and technologists find it difficult to communicate with common man in common man's language. At the same time, the common man too is unable to understand the language of scientists - technical texts with technical jargon, specific to the subject area. Now, the problem is obvious, as the two are unable to communicate with each other which leaves a wide gap between the two and which is growing day by day due to rapid advancements in our scientific knowledge. The task is really very challenging and it needs proper training and education in the field of science communication.

This paper attempts the contemporary status of science communication education in NE as well as it emphasizes the analysis of relevancy of the course curriculum in modern context. The research work highlights the various constrains and challenges ahead in this regard.

Keywords: Science communication, Education, India's North East

Introduction

Dissemination of the proper scientific information among the general masses is the need of the hour. It requires proper training and education in science communication process to create the ability to understand, digest and assimilate the complex scientific information and to present it in a simple, lucid and interesting manner to the masses in the language, comprehensible to them. Indeed we need science communication training and education. The science communication education in North East India is still in very much juvenile stage. The mass communication departments of different universities and colleges have started special papers on science communication or science journalism as specialization. Let us start this discussion with a comprehensive history of mass communication education in the region—

Mass Communication Education in India's North-East

Journalism and mass communication education was started in the state in 1960's. Though a few organizations started correspondence courses in journalism, yet at that time it was not recognized as an academic discipline. Gauhati University started the first journalism course in the state through conventional education system. The Department of Communication and Journalism of the university came into existence in 1967. Being one of the first ten university departments of journalism studies in the country it was started as a part of the Political Science Dept. under the able leadership of Professor K Venkatarao who was instrumental in setting it up. At first the department offered an evening diploma course which was later upgraded to a bachelor degree level course named 'Bachelor of Communication and Journalism' in 1994. In the year 1983, the department became a full-fledged department with an intake capacity of 25 students. The department started Master degree course named 'Master of Arts in Mass Communication' in 2005. This is a full-time four-semester two-year programme with a total of 16 papers with several options for specialization.

The department facilitates the students of masters level with a library, one computer-cum-multipurpose laboratory classroom, digital still and video cameras including handycams and PD-170, LCD projector with screen, an 11 KVA power back up system etc. The department also organized four Refresher Courses (Multidisciplinary) in Mass Communication since 2006–07 at the UGC-Academic Staff College of GU with sufficient number of participants. The department has five faculty members and a good number of guest faculties. Among them two are permanent lecturers, one is a senior lecturer under science communication project and the other two are lecturers on contractual basis.

Though the department of communication and Journalism of Gauhati University was established in 1967, but the department of Mass Communication of Assam University, Silchar started the first master degree level course in the state. This department started functioning in 1996 and since then it has been providing quality training and media education at postgraduate and doctoral levels. Prof. Partha Chatterjee, a renowned media educator of Kolkata took the initiative as the Professor and Head to upgrade the department with an excellence. The infrastructure of the department consists of a Video Studio, Audio Studio, Associated Control Rooms, and a comprehensive post production facility with audio edit suites, FCP non-linear editing, Computer Lab and screening hall. The department's TV studio is fully equipped with broadcast quality equipment coupled with online multi camera production facility. Adding yet another feather to its illustrious cap, the department has been recently granted a Major Research Project (MRP) by UGC, New Delhi on the thrust area of modern mass India.

The department has been offering four academic programmes, namely Master of Mass Communication (Four Semesters), M.Phil (three semesters), Ph.D. and D.Litt of the total seven faculties serving in the department one is Professor, one Associate Professor and the rest are Assistant Professors. Prof. K V Nagraj is working as the Head of the Department.

Established in 2001, the department of mass communication and journalism at the Tezpur Central University is one of its kind in the entire northeast to have state-of-the-art facilities with provisions for production of industry grade quality media content. The department offers a two-year (four semesters) Master's programme in Mass Communication & Journalism with an intake of 26 students. The curriculum combines theoretical studies of media with practical and skill orientation, which includes courses in Television Journalism and Production, Visual Communication, New Media Technology, Film Studies, Advertising and Public Relations, Development Communication, Communication Research Methods and Applications etc. The department also offers a Part-time Post Graduate Diploma in Community Communication from 2009.

The department facilitates the students with an exclusive computer laboratory, an audio visual studio with a fully equipped audio/video studio with digital non-linear and linear edit solutions, multi-camera set-up make learning a unique experience. The Department has two DSR digital cameras for high quality productions and three PD-150 digital cameras for ENG exercises. The post-production facility includes Apple Power Mac with the latest version of Final Cut Pro, Apple G4 with the Media 100 edit suit, professional audio production facility includes protol software with the sophisticated digital audio production units. Presently, Dr Abhijit Bora is heading the department.

Media and Communication Study Centre was started by the Entrepreneurship Development Cell in 2004 at Cotton College, Guwahati with the initiative of the Chief Coordinator and other members of the Entrepreneurship Development Cell (EDC) of the college and Dr Ankuran Dutta as its founder course coordinator. EDC was a five year project funded by the Department of Science & Technology and it was started in 2003. The media centre under the EDC initially started initially a 9 month course consisting of three level on mass communication in January 2005. Later the course became a self-financing PG Diploma programme. In 2008, the centre was renamed as Centre for Mass Communication & Journalism.

In the other seven states of the North East, Mass Communication education is comparatively new in their conventional higher education infrastructure. The Department of Mass Media, St. Anthony's College, Shillong is one of the pioneer in the field of mass communication education in the north eastern region. The Media department of the college has two separate graduate programs running. Mass Communication and Video Production were started on 14th of September, 1995 and the programme on Media Technologies was established on 13th of June 2001. St. Anthony's College started the undergraduate course in Mass Communication and Video Production in 1995, the first of its kind in the country, which has a national recognition for excellence and facility. It was in recognition to the pioneering effort of the college that the UGC sanctioned a second professional graduate course in Media Technologies in 2001. The two courses enable students to find their place among a burgeoning class of media professionals, not merely as multi-skilled technicians, but as individuals with a sound theoretical understanding of the larger social context within which the media industry functions. The department has surely prepared competent professionals in the fields of communication and journalism by instilling also a right sense of intellectual probing and responsibility.

In addition to this remarkable effort, Rajib Gandhi University of Arunachal Pradesh, Manipur University, Tripura University, Nagaland University, Mizoram University, Sikkim University and North Eastern Hills University have opened mass communication departments during past decade. The Department of Journalism and Mass Communication of Tripura University as established in 2009 at their main campus of Agartala. Mizoram University has started this department in 2010. The department in Manipur University was established in 2005.

In order to extend the benefits of the study of mass communication to any student interested in the field, the IDOL of Gauhati University started a PG Diploma programme in Journalism and Mass Communication and a two-year Master of Communication and Journalism (MCJ) programme from 2005 and 2008 respectively in open and distance learning system. MCJ is a modular yearly course. Under this scheme, a student successfully completing the first year will be awarded the PG Diploma in Journalism and Mass Communication and will be eligible for admission to the Final Year of the course. If they also successfully complete the Final Year module also, they will be awarded the MCJ degree.

The Directorate of Distance Education, Dibrugarh University also started a PGDJMC programme from 2007 for the distance learners of the state. In the next year, the university established a centre namely Centre for Studies in Journalism & Mass Communication and launched a regular P G Diploma course in conventional mode. Professor Kamala Borgohain is the Director in-charge of this centre. Earlier, the university established a Media Studies Centre in collaboration with the Vikalpa Trust of New Delhi and started two programmes, namely Animation & Digital Film Making and Digital Film Making & Recording Arts.

Meanwhile, Krishna Kanta Handique State Open University was established and its academic works started functioning from the mid of 2007. This first and only state open university of the north east launched a Bachelor of Mass Communication Programme for the first time in the region. After receiving a good response in the BMC programme, the University has started two UG level diploma programmes namely Diploma in Journalism & Mass Communication and Diploma in Assamese Journalism and two PG diploma programmes–PG Diploma in Mass Communication and PG Diploma in Broadcast Journalism. The university has also launched Master of Mass Communication from the academic year of 2010.

Science Communication Education in India's North East

In 2005, the National Children Science Congress was organized in Guwahati. The Congress was fully covered by the students of the Media and Communication Study Centre of Cotton College. During the NSCC, the then course coordinator met Dr. Dinesh Ch. Goswami, eminent science communicator and scientist of Regional Research Laboratory, Jorhat. In a meeting, Dr. Goswami advised on the funding provisions of the National Council for Science and Technology Communication, New Delhi for the mass communication centres. Then the course coordinator immediately took the initiative and contacted to the NCSTC for funding. At that time, science communication was a new concept among the faculties of Cotton College. The new course coordinator Ms. Anamika Ray took initiative to start a special paper in science communication. Then she participated in a workshop on curriculum development of science communication at Jaipur organized by the Department of Mass Communication of Rajasthan University in collaboration with NCSTC, Government of India. After receiving the technical knowledge on the running of a science communication paper in PG Diploma course, the course coordinator of MCSC prepared a project with the help of the authorities of EDC, Cotton College, especially Dr. S K Choudhury & Mr. S K Nath. The project was sanctioned by the NCSTC, Government of India to run a special paper in science communication in May, 2007. After receiving the financial grant from the NCSTC, the Media Centre of Cotton College incorporated a special paper on science communication in second semester of the existing PG Diploma programme. Dr. Manoj Kr. Patairiya, the Director of NCSTC took special care to start the project for the first time in the region. Inevitably, it must be mentioned here that, some science organizations of the state organized so many workshops and seminars on science communication or science journalism, but for the first time it has been incorporated in an academic discipline in the region.

On the other hand, with the support and help of Dr. Abhijit Bora, then Lecturer and Head of Department of Communication and Journalism, Gauhati University, a lecturer of the department Dr. Ankuran Dutta prepared a different project to start science communication special paper in the Master of Arts in Mass Communication course of the university. This project was also sanctioned by the NCSTC, Government of India in 2008, but the coordinator of the project Dr. Dutta has resigned from the department and joined the newly established K K Handiqui State Open University, Guwahati. Science Communication is running as an optional specialization in the third semester of MA Mass Communication course of Gauhati University. Assam University, Silchar has also started an optional specialization in science and technology communication in the final semester of masters programme from 2009.

With an objective to start different courses in science communication and to pursue research in the field, K K Handiqui State Open University has planned to establish a centre. The university is offering a compulsory course in the third semester of bachelor degree programme and an optional course in the masters programme. But still the other universities have not incorporated science communication as a special course in their syllabi. In the syllabi of the maximum universities of the north eastern region, there is a provision of a small unit or a part of a unit on science reporting or beat reporting on science, but there is no separate course on it.

Course Content

After examining the syllabi of Gauhati University, Cotton College, K K Handiqui State Open University and Assam University, the researchers have found a few important topics of science communication that have been incorporated. The following are some common topics included in the syllabi:

- Definition of Science Communication
- Importance of Science Communication
- Need of Science Communication
- Concept of Science Popularization
- Various formats of Science Popularization
- Science through Traditional Folk Media
- Health Communication
- Environmental Communication
- Concept of Scientific Advertising
- Preparing for Scientific Advertising
- Laws related to Science
- Writing of Science News
- Writing of Feature and Articles on Science
- Sources of Scientific Information
- Various formats of Radio Programmes
- Various formats of TV Programmes
- Writing for Radio and TV on Science

Academic Seminars/ Conferences in Science Communication in North East

Considered as an academic activity, Seminars and Conference have been organized by different initiatives on science communication as an academic discipline. MCSC, Cotton College organized a workshop in August 2007 and after that in April 2009, Department of Communication and Journalism, Gauhati University organized a seminar.

The 9th Indian Science Communication Congress was organized for the first time in the entire northeastern region of India in K K Handique State Open University. The main aim of the ISCC 2009 was to focus on the meeting point of science and common man through communication which will be for the benefit of the society. The Congress was organized by National Council for Science & Technology Communication (NCSTC) under Ministry of Science and Technology, Govt. of India and Krishna Kanta State Open University, Guwahati, Assam in collaboration with Indian Science Writer's Association (ISWA), New Delhi. The NCSTC, Govt. of India, has been organizing ISCC since the last eight years. The ISCC started from the year 2001. The meet has been organized in several cities, like Lucknow, Ranchi, Visakhapatnam, Gwalior, Varanasi, Ahmedabad, New Delhi and Chennai. The 9th Congress was organized at Guwahati.

The 9th Indian Science Communication Congress focusing on the theme "Science meets Communication" began on 20th December, 2009 with an introductory evening session on popular talks on Science Communication and formally came to an end with field visit for the participants on 24th December 2009. Around 180 delegates and participants attended the congress from all over the country.

Challenges and Recommendations

The researchers are actively involved in the science communication education in the north east. Therefore from the experience of the last five-six years, the researchers have realized the following challenges and would like to give some recommendations:

Lack of awareness/ importance on science communication education in North East

a. The mass communication discipline itself is comparatively new in the north eastern region. Except Gauhati University, all other universities have started mass communication courses in the last decade. So, importance on science communication is less among the institutions, who offer mass communication courses.

b. Lack of awareness is also another barrier. The concept of science communication is a new one and it is some time difficult to make the decision makers understood about the importance of science communication in the course of mass communication.

Negligibility of science communication in the syllabi of mass communication

We have gone through the various syllabi of different educational institutes, but found that the science communication is in a negligible position in the mass communication syllabi. Science reporting is only a small topic mentioned in the syllabi of different university's courses.

So, it may be recommended that science communication should compulsorily cover in the syllabi of mass communication courses and it must be incorporate as an optional course in masters level programmes. For example, without any financial assistance from the NCSTC or any other agency, K K Handiqui State Open University has introduced a full course of 100 marks on science communication in the third year of bachelor of mass communication programme as a compulsory course, not optional. The university has also included a full course of science communication in the final semester of masters degree programme.

Inadequate Financial Assistance to the mass communication universities

NCSTC is the nodal agency and the principal funding agency to run science communication course/ paper in the mass communication programmes. But, the NCSTC has given financial assistance only to Cotton College and Gauhati University.

They should encourage the other university to start science communication courses/ papers and the funding policies should be flexible.

Lack of proper infrastructure in the departments

It is noticed that the situation of the state universities or state funded institutions is very poor in contrast to the central govt. funded institutions and central universities. So, to improve the infrastructure of the department and to run a science communication course utilizing modern equipment and technology, the govt. should give a special fund to the institutes.

Lack of proper course materials of science communication

Science communication is a new area of study in the north eastern part of the country and course material on the discipline is very limited in the libraries. Text books are not available in the market. Therefore, the universities and the NCSTC may prepare some standard text books for this area of study.

Lack of experienced and trained resource persons

Another important challenge is the lack of proper trained and experienced person in the field. Therefore, NCSTC may organize some academic programmes like refresher course on science communication for the media educators.

Lack of model syllabus

A model syllabus should be prepared for different programmes. It is required to maintain the standard of the science communication programmes in different universities.

Lack of interest among the students

In the media of the north eastern state, science communication or a page/ space on science is not much popular. Therefore, the scope of the science communicator is less than other allied profession. In this connection, the institutions of national importance and the govt. should encourage the media to cover science stories as much as possible.

For society development it is very much necessary that common people should understand the science in right manner. This is the reason, science communication is required. But proper communication especially on science is very delicate and tough job which need proper education and training. With the help of Government and the transformation in common perception & attitude can change the scenario. And then only science communication can sustain in our society.

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103. e-VALIDATE: A Case Study on Building Remote Triggered Laboratories

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Abstract. Teaching science transcending barriers of society, national borders, and as right to education is a major uphill task that mankind faces today. Satellite and internet as a means of mass communication have shrunk the world today, making knowledge accessible to every doorstep. While video conferencing has effectively flung open the classrooms, a similar mass media technology that delivers a hands-on laboratory experience over the internet is still a major challenge. Laboratory experiments not only corroborate mathematical models used to describe nature they also highlight the inherent limitations of these models. Experiments and practical projects are indispensable tools that provide the framework for a learner to cope with real-world problems and gain hands-on experience. However, in last decade an increased private initiative in education has come with decline in the number of instructional laboratories replaced in most cases by an increased use of simulations which frequently replace physical experiments. Generally speaking, these simulator programs based on mathematical models are excellent tools for analysis and design only if the limits of the embedded models are known and the learner can cope with the abstraction level they represent. As mankind penetrates deeper and deeper into the mysteries of nature the number of physical experiments in education should have seen an increase instead of decline.

Advances in digital technology ensure most scientific instruments today can be made computer controlled without needing a physical access. With internet stitching computers into a World Wide Web, new possibilities come into being that promise to open up university laboratories to all those who aspire to study science and technology. Realizing this Ministry of Human Resource & Development (MHRD) has initiated through its National Mission on Education through Information and Communication Technology (NMEICT) a nationally coordinated pilot project on building Virtual labs that will facilitate elite educational and research institutions in India to open up their lab resources
24x7 beyond their campuses.

As a part of this national endeavor the Dayalbagh Educational Institute, has indigenously developed a Virtual Advanced Laboratory for Interactive Design, Analyze & Test in Electronics (eVALIDATE) that exploits current internet technology to convert a traditional electronics laboratory for open access (http://evalidate.freehostia.com). Innovative architecture of eVALIDATE exploits latest Ethernet based LAN eXtension for Instrumentation (LXI) interface along with a unique GUI that provides a near real life laboratory experience that is as genuine as possible despite only a remote access to the real lab hardware. This is a first of its kind laboratory in India and one of its own kinds on the international scenario. The aim of this paper is to showcase this enabling technology which has potential to empower teachers' in bringing real laboratory experience into a classroom that is perhaps as small as the whole world.

104. Role of Alternative Media in Developing Environment Awareness among University Students

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Abstract. The pen is mightier than the sword, and the alternative media may become mightier than the mainstream media. This is not a mere conjecture the process has already begun. The alternative media has emerged as a key player in promoting the various environmental related issues which is not getting mainstream media attention. The recent technological developments have reduced the cost of production dramatically. The speed of internet has increased with the development in the data transmission technology. This development has provided in the form of new media, a very strong tool of communication to challenge the monopoly of traditional mainstream media. The alternative media particularly Internet, Mobile Communication, Visual Radio, Ham operators, Small and medium newspapers and Community Radio have changed the way we were consuming the media products. Now the consumer is no more a passive receiver of the media content but involved in the process of collection, selection and dissemination of information. There is a large number of people who believe that media can be used as a tool for social change. The large number of people involved in developing and disseminating information can be a great source of information for hundreds and thousands of people all across the world.

In this modern society alternative media has emerged as a very strong force which is spreading issues of environmental awareness in a unique manner. A number of debate and discussions are taking place through the various social network sites. India is a young nation where more than 5o percent of the population in young and actively using alternative media as a primary source of information and communication. The present study is an attempt to understand the nature, role and impact of alternative media in spreading the environmental issues. The focus is to analyze the various issues that are frequently discussed by the young ones. The objective of the study is:

(1) To collect information about various alternative sources of information popular among the students;
(2) To study the media behaviour of students;
(3) To analyse the awareness about the various environmental issues ;
(4) To know about the most preferred medium of communication;
(5) To know about the actions taken by the students.

Keywords: Alternative media, Science, Awareness, Environment, Impact, Communication

105. Communication Hierarchy Analysis and Decision Making in Science and Technology Communication: How Much of What is Adequate for Desired Impact of Communication

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Abstract. Science and the method of science and the subsequent analytical techniques have been the hallmark of modern development, be it in sciences or even in humanities. These analytical techniques have increasingly been put to use across the entire spectrum of knowledge generation and its application. Why science communication should be away from developing these tools for democratising the subject in the sense that more and more human resource can be turned friendly to science communication and hence to the advanced world of sciences. It is high time that science communication should be demystified from the guarded codes of inclinations and experience to simpler training of quantification of ingredients of science communication and be allowed to flourish in a increasingly science consuming society.

Communication Hierarchy Analysis has potential to be able to fill this gap. For this it has been found appropriate to expand the horizon of science communication and the concept of total transfer of knowledge has been introduced and this has been named Total Communication. For this to be able to make the concept vividly understanding, communication of technology has also been considered within the greater realms of science communication as we generally tend to apply the term to general use. This paper recognises the very fact that different levels of communication produces distinctly different results. Emergence of such an analytical tool required higher level of understanding of the subject of science communication in terms of various skill groups such as linguistics, story weaving, communication and entertainment mix, illustrations including graphical, etc. Sooner it can be done, faster the objectivity of sciences can be imparted to science communication in particular and communication in general.

Keywords: Science communication, Science and technology communication, Communication hierarchy analysis, Total communication, Decision making tool

Introduction

Communication is a complex phenomenon that apparently looks simple. Various inherent process involved in communication are–the ‘source’ identifies the subject (topic) to be communicated, identification of the ‘target’ (to whom it is to be communicated), the form of communication, the level of communication, the amount of knowledge intended to be transferred, the dimensions (degree) of communication tools (voice, text, image, etc. and their mix), the objective, etc. The act of communication also involves simultaneous evaluation of the ‘receptivity of the ‘target’ and gap between ‘achieved’ and ‘intended’ level of the understanding it has made on the target.

In face to face communication this simultaneous correction are made impromptu and hence is most preferred for communication with higher prerequisites such as curriculum communication (teaching). The capacities to achieve these corrections make one a good or a poor communicator (teacher). It is for this very reason that interactive form of communication provides best results and curriculum teaching essentially employs this in conventional terms. This means that a communication other than face to face has to integrate these ingredients to be the most effective and how to achieve this is the key to its success. This paper attempts at quantifying the various parameters and helping arrive at the right mix for a communication. The clarity and quantification practised in science can help communication decode the abstract terms of likes of skill, understanding, etc. and put in place a well defined measure for assessing the content and its likely impact on the target of communication.

Principle of ‘ Communication Hierarchy Analysis’

Different forms of communication achieve different results. Sometimes it just provides information. This again can be amongst the peers or homogeneous groups or between two groups where one sits higher on the knowledge ladder and the other at lower levels. It is, at times derives different perspectives of the same information, sometimes

diagonally opposite. Adoption of a new device in the automobiles to control pollution has different meanings an environmental scientists and to an ordinary taxi driver. This difference in perspectives generated by communication
(by difference in the knowledge level hence different perception generated by a communication) makes way for various information grades in communication tools, which is necessary for amalgamating communication with complicated knowledge having societal implications and this is quite possible in science and technology (S&T) communication. It is therefore thought prudent here to analyse communication tools on the basis of this hierarchy in objectives and impact; delivery and acquisition; and literacy and knowledge prerequisites.

While first order hierarchy should infer hierarchy in basic communication delivery menus, such as speech alone, or together with text, visuals, caricature, audiovisuals, graphics, etc., the next order of hierarchy can definitely be objective linked. Here elements deriving importance should be retention, impact, knowledge level, level of enlightenment, etc., objective linked hierarchy is associated with the objective aimed to be fulfilled while carrying out communication activity. The author first proposed in the year 2009, the Principles and Basis for 'Communication Hierarchy Analysis' to understand the selection of the type of media, objectives achievable against the subject being taken up for communication activity and its nature. Ensuing classification satisfies this hierarchical understanding and the analysis subsequently completes the process involved.

Assumptions and Elaboration

In order to develop the principle of Communication Hierarchy Analysis, a new concept named 'Total communication' was proposed. It has made possible where the human race stand today. At the very basis of this hypothesis, lies the need for the communication. But then, the question arises, what level and form of communication. This paper has already recognised and discussed above the very fact that different levels of communication produces distinctly different results.

Emergence of science required higher level of communication skills and all higher or derived forms of knowledge emerging out of scientific advancements necessitated more effective forms of science communication. The concept of Total Communication is ever developing as itself the very tenets of science and technology. The concept of Total Communication necessitates highest extent of communication such that the source of that communication on knowledge front is matched by the receiver or the target to a great extent after the communication process is over.

'Communication Hierarchy Analysis'

Dimensional hierarchy
Verbal communication
Written communication
Visual communication (exhibits and displays)
Audio-visual communication
Hands on communication
Objective linked hierarchy
Information
Appreciation
Understanding
Learning
Total knowledge acquisition
Subjective linked hierarchy
Mass communication
Specialised mass communication such as for children
Education (training and teaching)
Science and technology (mass) communication and
Expert peer group communication

The Dimensional hierarchy is the first order analysis and deals with the very obvious analysis in communication. Whereas verbal mode is the basic but it is most essential. It can reach to every kind of target mass and it can also be utilised to reach common and specialised target audience. At the top of the hierarchy, here we have Hands on communication, which leaves minimal knowledge difference level between the source and the target. The methodology adopted here ensures that almost every aspect associated with the subject of communication is transferred to the target. The application of this method needs to be chosen keeping in mind the above effect (objective) namely Total Communication in mind, which the communication exercise is required to fulfil.

The Objective linked hierarchy is analysis based on objectives achievable through a communication activity. Information may not require as deep involvement of all the acquisitive learning faculties of the target involved. Total knowledge acquisition on the other hand, requires greater involvement of acquisitive learning faculties of the target. The results here are of highest order.

Subjective linked hierarchy analysis seeks its basis in the subject of the communication activity. For mass communication the generalist strategy is put to use which takes note of some basic commonly understandable concept to be communicated. Vocabulary usage depends upon this minimum understanding of the target associated with. Expert and peer group communication involves highly technical concepts and vocabulary in communication as
'expert' here becomes the 'generalist' (target). This group puts a lot of emphasis on the necessary skills and expertise of the communicator as well as of the receiver (target). Table-1 discusses the prerequisites demanded for the source and the target for Subjective Linked Hierarchy.

Table-1: Prerequisites for Subjective Linked Hierarchy

Subjective linked hierarchy **(increasing order)**	**Source prerequisite**	**Target prerequisite**
Mass communication	High knowledge level	
Threshold understanding		
Specialised mass communication such as for children	High knowledge level; Good communicative skills	Threshold understanding; Comprehensive skills
Education (training and teaching)	Higher knowledge level; Good communicative skill; Good assessing skills	High comprehensive skills; Expressive skills; Lower knowledge level
Science and technology (mass) communication	High know level; High communicative skills; Good simplification skills	Threshold knowledge level; Comprehension skills;
Expert peer group communication	Highly knowledgeable; Reasonable communicative skills; High comprehension	Highly knowledgeable; High comprehension; Reasonable communicative skills

Decision Making and Communication Hierarchy Analysis

Most of the time two parameters at the most are provided to the communication designer – the target audience and the objective. Entire strategy for effective communication now involves a series of processes involving identification, quantisation and analysis before deciding exactly upon the format and content of communication to be used. Following series of steps are undertaken to complete the process.

1. Target audience–Provides information and enables decision on Dimension Hierarchy Objective–Provides information and enables decision on Objective Linked Hierarchy
2. Both, the Target audience and Objective together enable decision on Subjective linked Hierarchy
3. These decisions enable quantification of level of Source prerequisites and Target prerequisites for each hierarchy
4. The combined output so collected from all the groups enable the communication designer to work out the nuts and bolts of the communication solution for a particular situation

This entire process has been explained graphically through a flow chart in Figure-1. The critical steps and issues involved during designing a communication solution is indeed a complex tasks requiring characteristic evaluation and deciding upon the structure and ingredients of a communication solution which will bear the greatest impact upon the target prescribed. Target audience and Objective when passed through the Dimensional Hierarchy Analysis and Objective Linked Hierarchy Analysis are able to decide upon the prerequisites based on these. That means now we know the requirements on the part of the source and the target as regard to the dimensions of communication must be involved. From consideration on the objective too the exercise is able to quantify prerequisites for both. It is now for the designer to employ Subjective Linked Hierarchy Analysis and complete the process for obtaining the solution for a communication need.

Science and Technology Communication

Science and technology (S&T) communication belongs to the Subjective Linked Hierarchy in the Communication Hierarchy Analysis. The need for S&T communication arises from the input provided by the previous two hierarchies, namely, Dimensional Hierarchy and Objective Linked Hierarchy.

The process of Communication Hierarchy Analysis

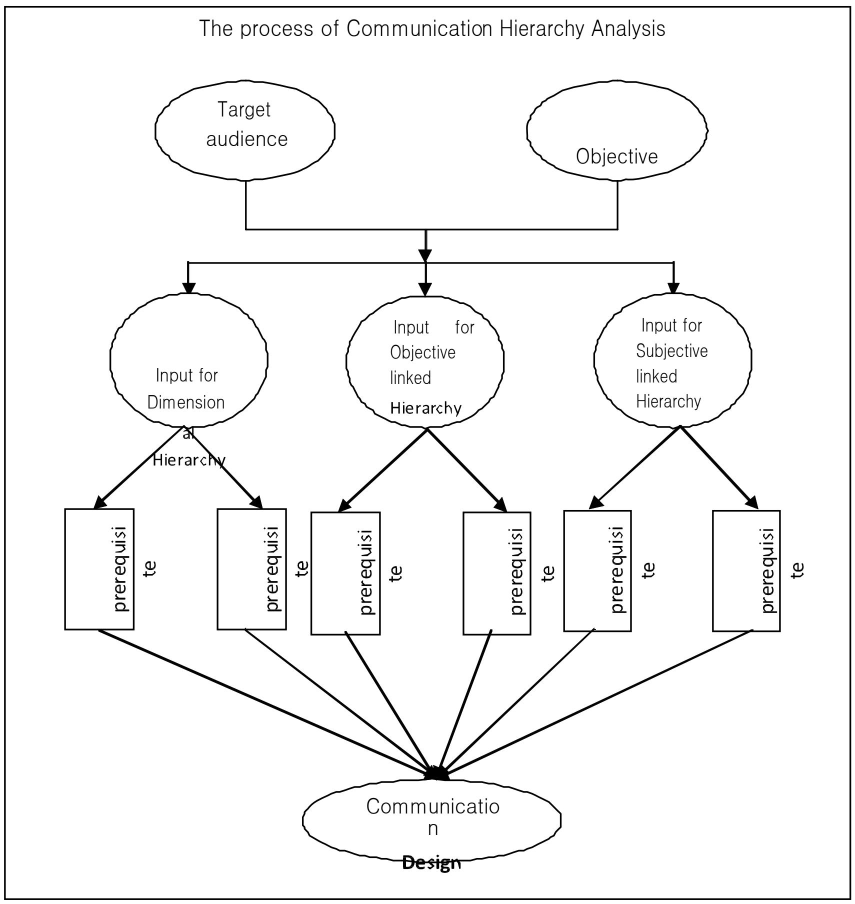

Figure. 1 Illustration depicting decision making requirements during designing of a communication solution

A communication designer now needs to take several set of decisions pertaining to source & target prerequisites and content prerequisites except one or more set which has been provided as the preliminary information. There emerges clear cut picture now for the source and target prerequisites after the entire analysis. It is now extremely easy task to draw lines for the content and hence its presentation.

While working for science and technology communication, it can be easily understood that the hierarchies belong to higher level. Complex subject relates to possessing higher degree of hierarchy and difficult becomes selection of the objective. Also, if you are required to select higher degree of hierarchy in any of the two groups, then there are some threshold prerequisites for the target to have already acquired in terms of the knowledge level associated with. This can very well be defined by the communicator involved. More importantly this can not be universal, every communicator has to evolve for his way of handling of the communication tasks and his expertise with the tools of communication to be put to use. But one thing can be very well understood that this is due to the different level of experience, skills and knowledge level of the communicator (source) and hence all the more necessary for a communication designer to specify the source prerequisites very carefully.

Technology communication in particular has another dimension. It is of transfer of technology. This is much more complex a task but relatively easy to carry out if all the requirements are met, as the 'source' and the 'receiver' both are in the highest state of effective 'transmission' and 'reception' of knowledge.

Conclusion

In designing a communication, there are several components (ingredients), which are required to be decided on the basis of the impact likely to be achieved. Conventionally it has been purely on the basis of experience and knowledge of the communicator. In the era of specialisation, communication is best designed by specialists, namely, communication designer. This is difficult in fulfilling as is difficult in concept level itself. Not anymore with a decision making tool for communication design, called – Communication Hierarchy Analysis. This involves analyzing the communication requirements on the basis of Dimensional hierarchy analysis, Objective linked analysis and Subjective linked analysis. Based on these, source and target prerequisites can be ascertained and the contents of the communication, its format and presentation can be worked out. This tool can be an asset especially while working in the area of science and technology communication.

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106. CSCs Towards e-Villages

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Abstract. Indian Government has initiated Common Service Centers (CSCs) across the country for the rural folk to obtain all the services through Internet. In Tamilnadu, the CSCs have been functioning since 2008 and at present around 2047 do exist. The present study is aimed to find out the services preferred by the users, the services offered, the challenges of CSCs towards sustainability and the citizens' perception. Tiruvannamalai district was selected for the study. Case study and indepth interview method was employed and officials in the TNeGA, SREI, operators and users of the CSCs were interviewed with semi-structured questionnaire.

Keywords: Common service centers, e-Governance, ICT, Sustainability

Introduction

Information and Communication Technologies (ICTs) are considered as the strategies to transform the world and to achieve most of the Millennium Development Goals (MDGs). ICTs have achieved a great extent of improvement in transparency, accountability, service delivery speed and lower service charges in the service process. E-governance can be explained as the use of Information and Communication Technologies by Government agencies to deliver the services to the citizens. Many of the Governmental agencies have succeeded in delivering the low cost, speedier and efficient services to the public.

India has witnessed so many successful ICT initiatives. The e-governance services have enhanced the efficiency of Educational, Revenue, Social Welfare, Transport, Passport, Commerce and other such services in India (Kumar & Best, 2006). Many researchers have documented the success stories of these initiatives. On the other side, there are researchers who studied the sustainability and applicability of these initiatives (Heeks, 2002 and Kumar & Best, 2006). Heeks explains about three categories–complete failure, where the goals were not achieved; partial failure, where the major goals were not unattained and successful, where most of the goals were achieved.

Shaun Goldfinch (2007) quoted that, 'the majority of the ICT developments are unsuccessful, particularly 'large' ones over $10 million. Indeed, 20-30% are abandoned altogether, while around half are over time, over budget and/ or do not deliver on expected applications or performance'. In India many of the rural based initiatives have failed to stand as the years went by. Chiraag Internet Centers were closed by the early of 2009, due to various reasons. Howard (2008) commented on such failures as, "the lapse is due to the many ill executed or misguided projects that failed due to limited local but-in, flawed economic models, inadequate training, and/or use of inappropriate equipment. From the perspective of donors, the most obvious failure of Information and Communication Technologies for development initiatives was that few were able to persist without their continued intervention and financial support, leading to an impression that Information and Communication Technologies for development projects are largely unsustainable".

Based on our various personal field visits to the rural ICT initiatives in the Southern India, have clearly showed that none of them are sustainable. It still exists as the initiators strongly depend on the funding from donor agencies. The dominant issues were lack of monetary benefit, lack of long term strategies, lack of periodical evaluation and research, lack of need and community based content creation, lack of local participation and lack of trained technical personnel to solve the problems without much delay. Even after the state's rural ICT profile has not showed positive response, there are agencies to implement the project. At this juncture, Government of India has initiated Common Service Centers (CSCs) across the country to make even a rural folk to obtain computer literacy and all the services at their door step irrespective of distance, space and time.

Common Service Centers (CSCs)

Ministry of Information Technology, Government of India had set up the National e-Governance Plan, through which it has planned to initiate a Common Service Center (CSCs) for each six villages all over the country. The Central Government funds and the state government implements the project through Public Private Partnership (PPP). Through bidding, the Government has selected the Service Center Agencies(SCAs) to deliver the services through Village Level Entrepreneurs(VLEs). Every CSC is equipped with Desktop PC/ laptop, printer, web camera, digital still camera, scanner and a high speed broadband connectivity. The total infrastructure costs around Rs. 1, 62, 000 and at the time of installation the VLEs need to pay Rs. 42,000 and the remaining amount will be arranged as loan and the VLEs are expected to pay back in installments. The VLEs were selected in consultation with the local bodies and screening, so as to make sure that the VLEs would serve the society. They should have the minimum pass of school education and they were trained by SCAs. It is mandatory for the CSCs to offer Government services to the citizens in the areas of e-governance, education, health, agriculture and commercial.

Common Service Centers (CSCs) in Tamil Nadu (TN)

The Government of Tamil Nadu through Tamil Nadu e-Governance Plan (TNeGP) has been initiating one CSC for three villages since 2008 taking one step ahead of the National plan. Two private firms were selected as the SCAs–Sahaj SREI and 3i-infotech through out the state. 3i-infotech has withdrawn from the scene after initiating the CSCs in all districts of Tamil Nadu except Chennai, Dharmapuri, Krishnagiri, Tiruvannamalai and Vellore districts. The VLEs are left without any help. Sahaj SREI has been operating in the four districts–Dharmapuri, Krishnagiri, Tiruvannamalai and Vellore. They are entrusted to provide Government services like land records, registration, issue of certificates, Government schemes, employment exchange, ration cards, electoral services, pension schemes, transport and public grievance. In Tamil Nadu there is a total of 5440 CSCs.

The Study

The broad objective of the present study is to assess the effectiveness of these CSCs initiatives in bringing change in the community and the contingency factors which affect the change in the existing situation. This study is aimed to find out the services preferred by the users, the services offered by the CSCs, the challenges of CSCs towards sustainability and the citizens' perception on the CSCs.

The researchers have adopted the intrinsic case study methodology along with the indepth interview. Everett Rogers (2003) comments that, "the usual survey research methods are less appropriate for the investigation of innovation consequences than for studying innovativeness. Extended observation over time or an in-depth case study is usually utilized to study consequences. Diffusion researchers have relied almost entirely upon survey methods of data gathering, ignoring the study of consequences, as the usual one-shot survey methods are inappropriate for investing the effects of innovations. An innovation's consequences cannot be understood simply by adding an additional question or two to a survey instrument, another hundred respondents to a sample population, or another few days of data gathering in the field".

The researchers have selected Tiruvannamalai district as it is backward socially, economically and in lack of computer literacy than the southern districts of Tamilnadu and also the services are implemented to the full extent. The district has 367 CSCs in the ratio 1:3. Interviews were conducted with 50 respondents which include officials in the Tamil Nadu e-Governance Agency (TNeGA), service providers (SREI), VLEs, CSC operators and users of the CSCs in various CSC villages with semi-structured questionnaire.

The Results

The study has clearly revealed that the project needs a midterm evaluation and different approach in the service implementation. The findings are discussed as follows:

Frequently used services

When the services, which are frequently accessed, are ranked, the offline services topped the list while the access to Government services left behind. The people have widely accessed the recharging service to recharge their mobiles and DTH. Photocopying and photo printing was used frequently as the villagers otherwise have to travel far to access these services. Very few people have sent emails and the youth have downloaded songs from the internet. Youth have also used the e-learning services. People also access the online ticketing facilities and the government certificates whenever they need. Many of the VLEs and CSC operators have expressed that they had to introduce the DTP and photocopying services to increase the users and gain income. They acknowledged the inefficacy of e-services alone to gain income in a rural setup. Some of the VLEs have even raised income by taking photographs to the village people. Initially, the majority of the VLEs have reported the centre has more than 15 visitors in an average every day. But later it has been revealed that most of the centers have stationary items in their shop and the people come for those purchases.

e-Governance services

The CSCs provide space for applying the Government certificates through online. The VLEs are authorized to submit the forms online after thorough inspection and to process the application to the district officers. In turn, they would get the certificates to supply them to the applicants in a due course. Most of the Indian villages are not connected with frequent transport. This would allow the people not to travel a long distance and no urge to wait in a long queue from morning to evening. Moreover these processes avoid the middlemen and promises transparency. But in some of the villages, the VLEs and the operators have said that most of the services which Government has introduced are yet to be initiated.

The people are enabled to make their petition every Monday to the District Administrative Officer (The District Collector) for all their problems to be solved at the District headquarters. So at present, the TNeGP has set up a provision that the people need not travel a long distance and they can file their petitions in the CSCs itself. But the Government officials do not open these online petitions and rectify them. It forces the people to lose their hope on e-governance system. Even in applying for the certificates, the incomplete forms are not reported back immediately. They are rejected, without the applicants being uninformed. So the people prefer to go in presence and get things done without waiting for a long time.

E-learning

With the partnership with Indira Gandhi National Open University (IGNOU), the CSCs offer diploma degrees and certificate courses on computer to the village people. Many of the school drop outs, young women and children avail these services. But the question arises whether the package was really "e" or not. Because the course material was completely stored up in the system and it seems like a multimedia module. But the interactivity feature of the module (which makes a slow, step by step learning possible) allows the village youngsters and children to learn computer and complete diploma and certificate courses.

Monetary benefit

The VLEs are not paid by the Government. But the private partnership enables them to receive subsidies and gifts. The private insurance and banking agencies are tied up with the CSCs for insuring and buying property or vehicle. If the VLEs find customers for the agencies, they would be gifted subsidies. So the VLEs try to publicize the benefits of private services and not the information service of the Government, which will be of little benefit. Moreover, people are still trained to invest their money in various businesses.

The installation amount forces the VLEs to charge higher amount as they want to get rid of the debt at the earliest. But the poor people feel they are charged high, which in turn minimizes the number of visitors. The Government has offered many schemes before the CSCs were initiated, but most of them are not yet introduced. So the VLEs feel as if they are cheated and they could not make profit out of it.

Social prospects and challenges

Though the VLEs are men, majority of the CSCs are run by female. They either allow their wives to look after the CSC or select the young girls in the village to look after the CSC as they strongly believe in the managing strengths of women and trustworthiness. This changes the village scenario and allow for the participation of the women in public participation, discussion and decision making.

There is a serious issue of caste (social class) discrimination. The CSCs have to be set up in the common place where all the people can access easily. But if the selected VLEs belong to the lower social class, they do not either own a place in a common place or get for rent easily. One of the VLEs has reflected that he has to pay more than it deserves as he belongs to the lower social class.

The uneducated old aged people do not understand the applicability of the eservices. So at time, they create problem and the VLEs have to struggle a lot to get things settled. The economically deprived people do not use the services as they think the technology is for the rich. But the rich people threaten and try to influence the CSC staff to get the benefits at the earliest. Only the literate folks access and browse through the internet for various things. The illiterates get the services through the technical support of VLEs.

Technical issues

CSCs are not conferred with fast broadband services. In the middle of the process, the connection gets disconnected and the uneducated get irritated of this technology and avoids to use eservices. The technical support was also very low as the technical errors are not rectified at the earliest. These factors force the VLEs to prefer offline services much than the online services.

Recommendations of the Study

1. Rather than partnering with the private agencies, the SCAs should try to hold partnership with the local bodies. SCAs generally sign MOUs with the private bodies but without knowing the real need of the people. A need based study should be implemented to evaluate and improve the project.
2. The goals of the services are yet to be refined and it is a doubt whether the services would contribute to the poverty reduction. The researchers could not find benefit for any of the citizens apart from applying the online certificates. It should be also noted that people would not need certificates through out the year. So some amendments need to be made for consistency and sustainability.
3. It has been evidently proved that the Government has been using these services for election strategies as the processing fee is minimized for a short period to access the eservices. If they increase the fee, the people would not depend on it more and the model would fail. VLEs have to charge as they have invested more. The Government can move the CSC's control either to the Self Help Groups or local administrative bodies and cut off the rates. So the entire community would be benefited.
4. There is a need for some campaigning strategies to increase awareness among the rural users especially the aged and uneducated, as they are the strong opinion leaders of the society.

Conclusion

The world is moving towards the mobile revolution in a rapid pace. The developing countries are testing the m-commerce, m-governance and so many other m-developmental initiatives. Mobile has deep rooted in the Indian society than any other medium. People of all classes use the mobiles. Rather than distributing free television sets, the Governement can spend on installing new applications which would allow the people to access all the services not even at the door step, but at their private rooms. There are other serious issues to be dealt within the society before taking internet and computer. And moreover, the mobiles are user friendly than the computers. So it is the time for the Indian Government to stop spending money on the rural ICT initiatives and try to improve the research on m-governance.

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107. Communicating Bioinformatics

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Abstract. With the advent of computers, humans have become 'data gatherers', measuring every aspect of our life with inferences derived from these activities. In this new culture, everything can and will become data (from internet traffic and consumer taste to the mapping of galaxies or human behavior). Everything can be measured (in pixels, Hertz, nucleotide bases, etc), turned into collections of numbers that can be stored (generally in bytes of information), archived in databases, disseminated (through cable or wireless conduits), and analyzed. We are expecting giant pay-offs from our data: proactive control of our world (from earthquakes and disease to finance and social stability), and clear understanding of chemical, biological and cosmological processes. Ultimately, we expect a better life. Unfortunately, data brings clutter and noise and its interpretation cannot keep pace with its accumulation. One problem with data is its multidimensionality and how to uncover underlying signal (patterns) in the most parsimonious way (generally using nonlinear approaches [1-3]). Another problem relates to what we do with the data. Scientific discovery is driven by falsifiability and imagination [4] and not by purely logical processes that turn observations into understanding. Data will not generate knowledge if we use inductive principles. The gathering, archival, dissemination, modeling, and analysis of biological data falls within a relatively young field of scientific inquiry, currently known as 'bioinformatics', 'computational biology', 'biomolecular informatics', or 'computational molecular biology'. Some terms are more restrictive than others and some also refer to the use of biological macromolecules as computing devices (e.g., computational molecular biology). I have chosen to refer to this data-driven field as bioinformatics.

Even though technology and information is increasing in biological sciences, many students are being left behind. Bioinformatics is one such field where students are not being properly informed of the opportunities. Therefore, science teachers need ways to teach this subject to their students. Activities for students on bioinformatics should be inquiry-based and relevant to their lives. Before activities can be completed, a brief history of the subjects is needed. In addition, the basic background information of genomics and bioinformatics is presented. Applications in science and in their lives is shown to allow students to understand relevance of bioinformatics. The activities devised begin with students using a chromatogram to obtain a gene sequence of about five base pairs. After obtaining their gene, the student complete by hand a worksheet in which they match their gene to the one out of five example genes. This activity is devised to allow the students to fully appreciate that the computer can accomplish in a matter of seconds when humans take hours to complete. Afterwards, they use the actual bioinformatics computer search tool to seek a match to their gene sequence. Once they have found a close match, they report on the structure and function of their gene. These activities are devised to allow the students to appreciate what scientists do and perform the same tasks scientists do everyday in an actual lab setting. In addition to using the information and activities in the biology curriculum, they can also be used in the mathematics curriculum, especially Discrete Mathematics and Advance Placement Statistics. The activities provide an ideal opportunity to integrate mathematics and science education. The activities are also suited to collaboration among computer science and biology teachers. In collaborating with a biology teacher, a computer/technology skills teacher could design a lesson on bioinformatics. In society today, the uses of technology are rapidly increasing and improving. Teachers need to work to stay informed on new technologies to be able to inform students of the many opportunities available. Through explaining bioinformatics to students, teachers give students a head start into the opportunities available. The information and activities provided can help teachers accomplish this task.

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108. Scienfotainment: Popularising Science through Entertainment

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Abstract. The essence of Science Communication lies in establishing the fact that science is a necessity that stems out of life problems itself. Formal education may propel Science but the inventive capacity developing in the course of meeting those life problems in an uneducated individual can any day change the shape of the world. The only lacuna towards this is promotion of that scientific intellect that may be budding in any orthodox tribal community of Madhya Pradesh or some poor village in the islands of Trinidad and not necessarily in a sophisticated R&D laboratory of a multi- national company. Any local invention taking place in a greased congested motor garage could just have potential to give jitters to the R&D expert team of an automobile giant. Identifying a talent of the sort & creating its visibility from a local arena to a global platform through Science talent hunt is the gap that Science Communicators can fit in. In my opinion, communication can serve as a mediator to link local talent to the outside world through the concept of 'Scienfotainment' which would amalgamate Science with entertainment and magnify its impact. This would be a leap towards promoting scientific & rational attitude through novel science talent shows that can be telecasted worldwide. Patents can be granted to those inventions which hold commercial viability thus benefitting the local talent. Global Science communication would emerge as a new face evolving from the local scientific communicators struggling to get better visibility in today's time.

Proposed model

Convergence of local Science Graduates/ Post –graduates/Academicians with interest/background in communication
Dig out local & indigenous inventive genius in all possible scientific arenas from a garage boy (mechanical field) to a farmer who might unknowingly be cultivating a new disease resistant variety crop by specific crossing (genetics)
Laying the foundation of "Scienfotainment Concept".
Amalgamation of Science with entertainment.
Utilise local media tools (electronic & print) to organize Science talent shows (much like dance & singing & reality shows like Dance India Dance, Meri Awaaz Suno, Big Brother etc.)
Identifying Channel Sponsors & Creative Heads (National level) to feature a serial based on the novelty of the concept & the innovation mix it can offer to the public and even the innovation incubator firms which might readily promote a feature of the sort.
Taking care of legal implications: Patents may be granted to such innovations that have the potential of commercial exploitation.
The Concept of 'Scienfotainment' may be picked by international channels as well
(In the same way as the reality show concept was taken up by India most readily; with the difference that this time India will have something new to offer to the globe).

Application extents

- Promotion of Science & Scientific temper through communication channels
- Filling the gap between local & global science communication channels in a glamorized manner
- Morally encouraging the local inventive genius
- Financially crediting the inventive genius(depending on patentability criteria of commercial exploitation)
- Opening a new creative module in entertainment business
- Signifying the outreach of Scientific Communicators

109. Analytical study on Health Communication Theories and Models in Communicating Health Messages through Media Strategy: with Special Reference to Women

Srijothi Pichaimuthu

Abstract. The deadly H1N1 influenza virus that's fueling fears of a global pandemic is combination of pig, human and avian influenza strains. The findings may resolve some uncertainty about the nature of the virus, but much is still unknown about its origins and effects for most of the people. In recent years health professionals have developed a growing appreciation of the critical role that communication plays in healthcare. The effective communication of information on medical technology conditions, diseases, medicines and healthy lifestyles has played an important part in the improvement of the health status of the people widely. At the same time, it is hard to ignore the cynical impact that ineffective communication can have within the health issue arena. This recognition of the impact-both positive and negative-of communication in dealing health issues and communication is generating upward interest in the field of health communication

The media coverage on public health information and crisis is gathering momentum with advancement of science and technology. It plays an essential role in informing, communicating, educating and sensitizing the public on global and local health issues. And also has the potential to influence the government's decision-making on health care policies. But, during the swine flu outbreak in 2009, both traditional and new media were largely criticized for sensationalizing the issue as India was one of the least affected countries in the world.

The Health communication message through different media strategy reaches the people in different bang to create various effects in the society. The theories and models of health communication explain the strategy of communication channels reaching out the target with messages and also explain the attitudes of people behaviors and practice through communication. The aim of the research is to analyze influencing effectiveness of health communication messages from various communication channels among women and comparatively analyze with health communication theories and models. Perhaps the media coverage and different kinds of communication of the swine flu through various media has outbreak in 2009 in the India. The objective of the research is obtained by the survey method and in-depth interviews. The gathered opinions are comparatively analyzed with the health communication theories and models to find the effective results.

Keywords: Health communication, swine flu, media, strategy, messages, behavioral changes.

Introduction

Health communication encompasses the study and use of communication strategies to inform and influence individual and community decisions that enhance health. It links the domains of communication and health and is increasingly recognized as a necessary element of efforts to improve personal and public health. Health communication can contribute to all aspects of disease prevention and health promotion and is relevant in a number of contexts, including (1) health professional-patient relations, (2) individuals' exposure to, search for, and use of health information, (3) individuals' adherence to clinical recommendations and regimens, (4) the construction of public health messages and campaigns, (5) the dissemination of individual and population health risk information, that is, risk communication, (6) images of health in the mass media and the culture at large, (7) the education of consumers about how to gain access to the public health and health care systems, and (8) the development of tele-health applications.

For individuals, effective health communication can help raise awareness of health risks and solutions provide the motivation and skills needed to reduce these risks, help them find support from other people in similar situations, and affect or reinforce attitudes. For the community, health communication can be used to influence the public agenda, advocate for policies and programs, promote positive changes in the socioeconomic and physical environments, improve the delivery of public health and health care services, and encourage social norms that benefit health and quality of life. Over the last 50 years, social scientists have advanced various theories of how communication can influence human behavior. These theories and models provide communicators with indicators and examples of what influences behavior, and offer foundations for planning, executing, and evaluating communication projects (Piotrow, Kincaid, Rimon, & Rinehart, 1997).

The World Health Organization (WHO) defines health communication as a key strategy to inform the public about health concerns and to maintain important health issues on the public agenda. Health communication is directed towards improving the health status of individuals and populations. According to that definition health communication does not include all health-related media texts but only those engaged in positive effects on health. Thus health communication research is concentrated on finding out what kinds of health stories are published and what kind of health messages reach the general public to bring the effective changes in behavior among them and also if health facts are accurate and influencing and how health stories affect the people through different communication strategy.

Health and illness are among the most popular topics in today's media. Health and medicine are not only newsworthy but are used everywhere in all the media from editorials to soap operas and from books to Internet. The Economist on November 13, 2009 in its article "Predicting the path of the swine-flu pandemic" reported the first pandemic of the 21st century will expose stark differences between the world's rich and poor, predicts Margaret Chan, director-general of the World Health Organization. The reason that the health communication gets all the much acclaimed attention is because health and well-being are issues that concern everyone. On one hand medicine is a matter of death and life so medical actions are good items for dramatic - factual or fictional - stories, too. On the other hand today's health care system and health professionals are more interested in co-operation with the media.

The recent hardtalk on the news media related to health issues was the swine flu pandemic outbreak worldwide. The sub type of Influenza A [H1N1], was first reported in Mexico on 18th March, 2009 and then spread to neighboring United States and Canada. As on 8th June, 2009, World Health Organization has reported 25,288 laboratory confirmed cases of influenza A/H1N1 infection with 139 deaths from 73 countries spread over America, Europe, Asia and Australian continent. The flu was comparatively less vulnerable than the regular seasonal flu with lower casualties. But the rate of transmission of the virus across the continents within a short time span made WHO declare the swine flu pandemic alert as Phase 6 in June 11, 2009. (Dumar, 2009)

The media has a set of standards and ethics to adhere to at propagating information, and plays a more crucial role in reporting global health crisis situations. Increasing competition for readership and the TRPs has made the traditional media prioritize its commercial interests. News journalism in specific is often questioned for its credibility and sensibility with the general public relying much on the news stories and the media coverage for their information. The recent swine flu outbreak in 2009 equally alarmed the WHO and people around the world. The medical professionals and the research scientists themselves were lost for explanations or predicaments, whatsoever on the A (H1N1). At this point, with the globalization of media content and the advancement of communication technologies, our world was enveloped, rather bombarded with message explosion. The media campaign of the swine flu in India in the newspaper, television and radio medium was considered for analysis.

Swine Flu In India

In India, more than 75% of all infected persons were urban dwellers, suggesting that efforts were concentrated in urban communities. (source: 2009 Pandemic Influenza in India) And so the swine flu outbreak was efficiently contained in the cities by the government through appropriate measures and very sparsely affected the rural regions. WHO released its weekly situation updates on the global alert and response section of its website. According to the latest release (WHO - Pandemic (H1N1) 2009 - update 95) on April 9th, 2010, over 17700 deaths have occurred worldwide due to the swine pandemic outbreak. In South Asia, limited data suggests the most active areas of pandemic influenza virus transmission continues to be in Bangladesh, where an increasing number of cases have been detected since late February 2009. Overall pandemic influenza activity remained low across the rest of the subcontinent with persistence of low level circulation of pandemic influenza virus in western India.

Fig. 1.1 Status of swine flu pandemic in the world on august 6th 2009 (Source: WHO website)

Fig. 1.2 Status of swine flu pandemic in the world on april 4th, 2010 (Source: WHO website)

Swine Flu In Media

The worldwide media coverage of the swine flu pandemic outbreak in 2009 especially shows an in-depth insight into the difference in the way media organizations have covered global issue. Television is by far the most popular medium among all kinds of people. Even so, it’s important to pay attention to newspapers to understand what constitutes health care news. Major daily newspapers cover a broad range of health topics more regularly and in greater detail than most television news programs. Television news staffs often look to local or national newspapers for direction on what stories to pursue. But a television coverage and television advertisement veers toward those events that have a strong visual component and away from issues like health policy that require in-depth exploration.
(Buresh and Gordon, 2006)

Indian Scenario Of The Swine Flu Outbreak ‘ 09

“As on 29.05.2009 there is one imported case that came from U.S.A. There has been no secondary spread from that index case. However, with efficient human to human transmission established and more than 48 countries involved, it is a matter of time that this pandemic strain would come to India. The behavior of this mutant virus among the Asian population cannot be predicted. The virus has the potential to mutate further and become a lethal virus.” (Source: Ministry of health and family welfare website)

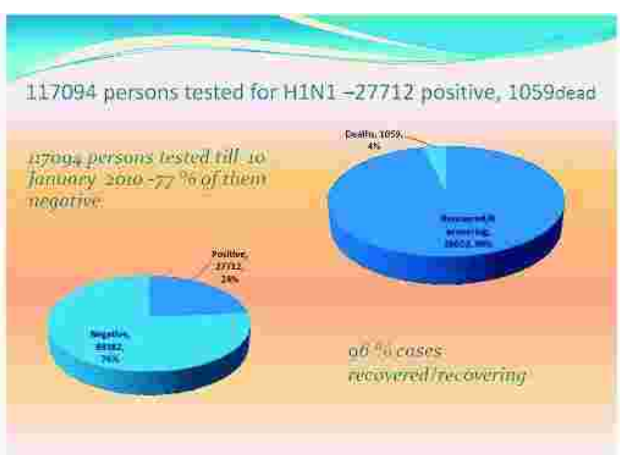

Fig. 1.3 Statics on h1n1 affected indians on january 10th 2010 (source: Ministry of health and family welfare website)

Fig. 1.4 Media campaigns on swine flu awareness in print
(Source: Ministry of health and family welfare website)

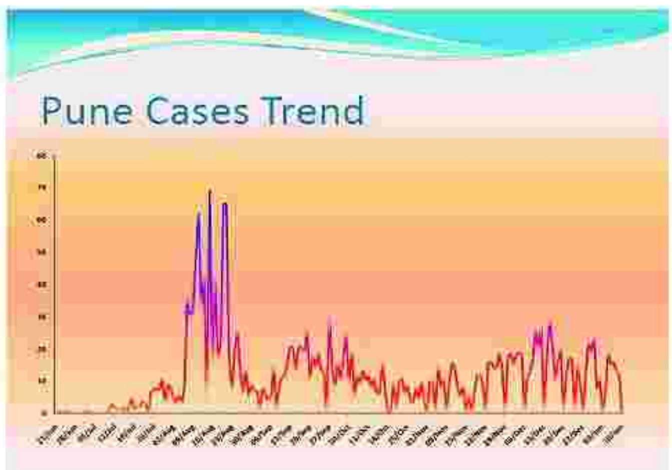

Fig. 1.5 The pattern of city-wise swine flu mortality in pune up to january 10th, 2010 (source: Ministry of health and family welfare website)

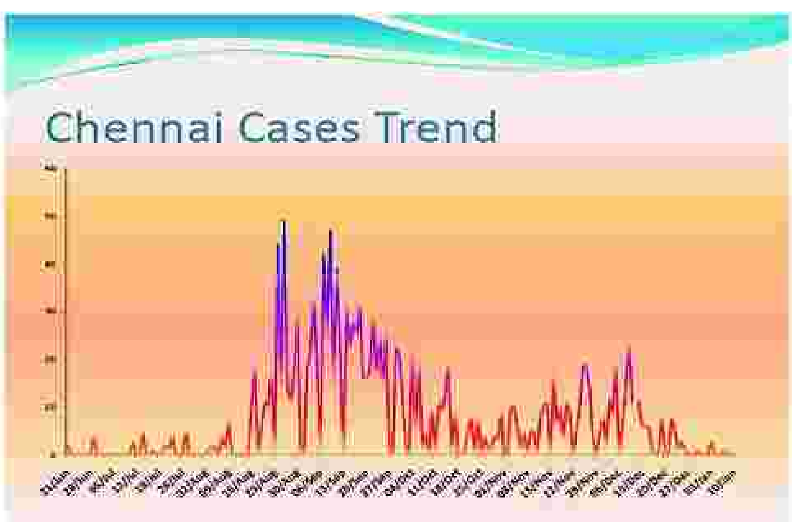

Fig. 1.6 The pattern of city-wise swine flu mortality in chennai upto january 10th, 2010 (source: Ministry of health and family welfare website)

The Press Information Bureau would ensure press releases and arrange for media briefing. The identified authority would only brief the media.

From the data given by Ministry of Health & Family Welfare–Government of India, it's evident that India reported increasing number of swine flu cases since August. And the confirmed case continued to be detected at a lower rate till the end of March 2010. Both Pune and Chennai recorded high mortality in August and September, and slowly reduced due to several factors including government's pandemic intervention strategy and preparedness, climatic conditions and others.

(As on 11th April 2010)

S.No.	State	Lab confirmed cases reported during the day	Lab confirmed cases cumulative	Death of lab confirmed cases during the day	Death of lab confirmed cases cumulative
1.	Delhi	[illegible]	[illegible]	[illegible]	[illegible]
2.	Andhra Pradesh	[illegible]	[illegible]	[illegible]	[illegible]
3.	Karnataka	5	[illegible]	[illegible]	[illegible]
4.	Tamil Nadu	0	[illegible]	0	7
5.	Maharashtra*	1	[illegible]	1	[illegible]
6.	Kerala	[illegible]	[illegible]	[illegible]	[illegible]
7.	Punjab	[illegible]	[illegible]	[illegible]	[illegible]
8.	Haryana	[illegible]	[illegible]	[illegible]	[illegible]
9.	Chandigarh(UT)	[illegible]	[illegible]	[illegible]	[illegible]
10.	Goa	[illegible]	[illegible]	[illegible]	[illegible]
11.	West Bengal	[illegible]	[illegible]	[illegible]	[illegible]
12.	Uttarakhand	[illegible]	[illegible]	[illegible]	[illegible]
13.	Himachal Pradesh	[illegible]	[illegible]	[illegible]	[illegible]
14.	Jammu & Kashmir	[illegible]	[illegible]	[illegible]	[illegible]
15.	Gujarat*	[illegible]	[illegible]	[illegible]	[illegible]
16.	Manipur	[illegible]	[illegible]	[illegible]	[illegible]
17.	Meghalaya	[illegible]	[illegible]	[illegible]	[illegible]
18.	Mizoram	[illegible]	[illegible]	[illegible]	1
19.	Assam	[illegible]	[illegible]	[illegible]	2
20.	Jharkhand	[illegible]	2	[illegible]	[illegible]
21.	Rajasthan	[illegible]	[illegible]	[illegible]	[illegible]
22.	Bihar	[illegible]	7	[illegible]	[illegible]
23.	Uttar Pradesh	[illegible]	[illegible]	[illegible]	[illegible]
24.	Puducherry	[illegible]	[illegible]	[illegible]	[illegible]

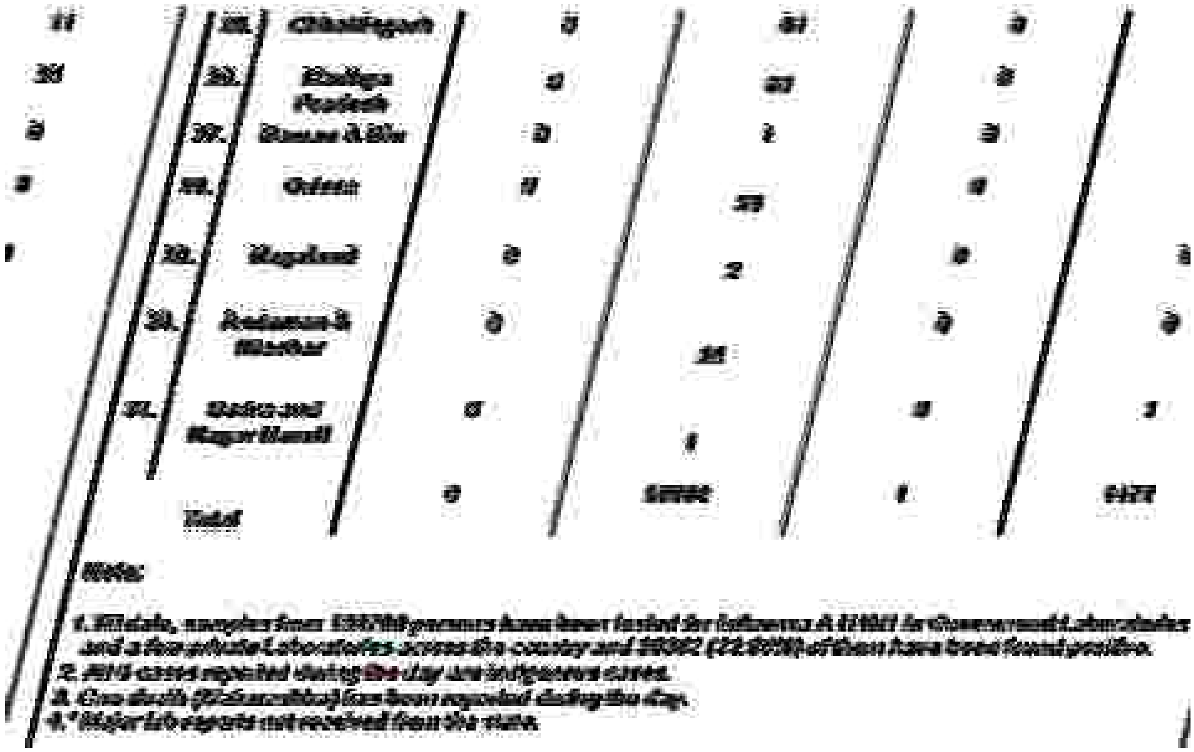

Fig. 1.7. Status of influenza a(h1n1) in India as on april 11th, 2010 (source: mohfw website)

In the preparedness and response plan when India was affected, the Ministry of Health & Family Welfare strategized mass risk communication and media relations as essential part of the strategic approach. The communication need to be specific to the situation since even a few deaths in the initial clusters will create large scale panic. The communication should re-enforce actions to alleviate the fear among public. It should also be direct for the community to report immediately when they start showing symptoms. The non-pharmaceutical interventions also needed to be supported by a media campaign. At the grass root level, there should be social mobilization to sustain positive health seeking behavior. Effective risk communication, supported by confidence in government authorities and the reliability of their information, may help mitigate some of the social and economic disruption attributed to the pandemic. In this case this study helps to identify how effectively different health communication message has reached women in urban areas to give awareness and knowledge about swine flu. The influenced communication message would have brought some changes in the behaviors and practices among them by taking a preventive health measures.

Objectives

- To find the impact of health communication of swine flu among urban women community.
- To analyze the nature of the content of the persuasive messages by different communication campaign.
- To study the health communication theories and models
- To analyze theories and models of health communication with the effective communication strategy of swine flu campaign.

Review of Literature

Pandemics

Dumar (2009) defined that the word “pandemic” comes from the Greek (pan) meaning “all” and (demos) meaning “people”. It is an epidemic of infectious disease that spreads through population across a large region, for instance a continent, or even worldwide. According to the World Health Organization (WHO), a pandemic can start when three conditions have been met:

- Emergence of a disease new to a population.
- Agents infect humans, causing serious illness.

- Agents spread easily and sustainably among humans. A disease or condition is not a pandemic merely because it is widespread or kills many people; it must also be

infectious. For instance, cancer is responsible for many deaths but is not considered a pandemic, because the disease is not infectious or contagious.

Moeller (1999) states disease, especially epidemic disease is not only a biological phenomenon but a social, cultural and political one. How societies respond to catastrophic outbreaks of disease is measured by their level of emotion, their trust in science and medicine, their experience of pain and illness and their reaction to disability and death. The media's greatest level of attention is reserved for epidemics that are novel, violent and intense and pose at least a perceived danger of breaking out of their bounds to threaten the nation. Therefore, in these instances, media audiences are especially dependant on the media as information sources and for guidelines about how to feel and how to react. Dramatic and tragic elements are emphasized by a focus on individuals and a more vivid use of language and metaphors. Although the outline of the media's response to epidemic diseases remains remarkably constant among outbreaks, the tone of the coverage can vary.

Lemon and Hamburg (2007) state widespread media coverage of epidemics is hardly news and is an essential part of any epidemic. The media has the power both to inform and to misinform. Because the media powerfully shapes the public's perception of an epidemic, the details of how popular communication is carried out are of utmost importance. Today's coverage of pandemic events differs from previous eras in the technology, speed, and variety with which news reports are generated. In the early twentieth century, for instance, American consumers relied heavily on an extensive print media, whereas consumers today can turn to panoply of newspapers, magazines, television, radio, cable, Internet sites, Web logs and discussion groups. Nonetheless there is no question that the breadth of media genres–and the demographics of their consumers–is far greater today than in previous eras, and there is no doubt that the media has a far greater ability to provide consumers with both useful information and misinformation.

Blum and Knudson (2006) state "No one knows exactly how serious this threat could be. Nevertheless, we cannot afford to take a chance with the nation's health" with these words on March 24, 1976, President Gerald Ford launched one of the greatest debacles in public health history–the campaign to vaccinate every American against swine flu, the same virus that had swept the world in the great flu pandemic of 1918. The story splashed over the front page and dominated the nightly news on television. It transcended traditional beats - as all big public health stories do–and involved politics and economics as well as science and medicine. The swine flu story broke all the rules of conventional medical reporting and would forever change the way, public health is covered.

Rubin and Hendy (1977) in their paper state that press coverage of the swine influenza inoculation campaign was generally superficial and marked by a "body count" mentality, but it was rarely inaccurate or sensational, as has frequently been assumed. A study of coverage in 19 daily newspapers, the three television networks, and a wire service shows that the best work was done by science and medical writers on major metropolitan newspapers. Television newsmen and wire reporters were unprepared for a story of such complexity. A weak press relations effort by the Center for Disease Control and other public health agencies contributed to the public's confusion and upset professionals in the press. A better understanding by doctors of how the press works and closer relations between the medical community and the press can improve coverage of future public health programs.

Health Communication

Rajan (2005) states that in the 1970's and 1980's, health beat consisted of regular assessment of the state public hospitals. Such scrutiny by the media put necessary pressure on these public institutions that are the lifeline for the poor in particular. Without the glare of media publicity, such institutions could literally get away with media publicity; such institutions could literally get away with murder. Today, instead, there are endless pieces on the new super-specialty hospitals, part of the growing, private health care sector. Such articles are usually prompted by public relations agencies hired by the hospitals to raise their profile in the city. But if new drugs or new technology related to heart diseases are available, even outside India, such news will be splashed all over the papers, often on the front page.

Atkins (2002) states a major player in the Indian press is The Times of India, which has expended from its western India origins to become a national force. It is considered trailblazer–albeit a sometimes ruthless one – in instilling an assembly-line mentality in the newsroom, it views stories as products and readers as consumers. In all fairness to the Indian press, many newspapers maintain a high standard of ethics and continue to do hard-hitting, socially relevant stories on child labour, women's health, education and other issues. An example is the coverage in mainstream newspapers of the continuing health problems related to the industrial disaster at the Union Carbide Corporation plant in Bhopal in 1984, an explosion and gas leak that killed more than 16,000 people. Still, these are the exceptions, not the rule.

Buresh and Gordon (2006) describe that today people have unprecedented access to research and other materials that used to be available only to health practitioners through newspapers, popular magazines, television news, or Internet sites. Studies suggest that many Americans rely on the media and the Internet as their primary sources of health information. As a National Health Council report put it, “The media have become an integral member of America’s health care team”. Many cultural, political, and economic factors have contributed to the media’s unprecedented power to inform and influence people about their personal health and health care.

Aggarwal (2002) states that with the fragmentation of the media audiences into specialized target groups having their own specific agenda of uses and gratification from the media, the genre of journalism too has undergone subject specific-fragmentation. The growth of health-consciousness in the people of the developed world and disease- consciousness in the people of the developing world had spurred this Janus-faced process of fragmentation towards the evolution of medical/health journalism.

Boyce (2006) in his paper presents findings based on a media analysis of television, radio and newspapers, interviews with journalists and sources and the results of national surveys and focus groups with parents and uses a recent medical controversy in the UK as a backdrop to explore expertise. In 1998 a scientist claimed there might be a link between the measles, mumps and rubella vaccine and autism. His claims received significant media attention and vaccination rates fell across the UK. This case study examines how journalists constructed expertise, how key sources presented themselves as expert-sources and the effect of balancing expert-sources with sources.

Hinnant and Len-Rios (2009) in their research paper using interviews with 20 writers and editors for magazines and newspapers coupled with a national survey (N = 396), this analysis uncovers journalistic techniques and tacit theories for making information understandable. The journalists evince a basic understanding of how health literacy can be enhanced through certain story elements (such as nontechnical word use), but they also maintain false ideas about appropriate comprehension aides (such as statistics). Findings show that journalists struggle to maintain scientific credibility while accommodating different audience literacy levels. Journalists’ definitions of health literacy strategically carve out a place for their work as translators.

Johnson (1998) states the impact of the media in supplying the public with health information, can be considered with the following results from a national poll of 2256 adults commissioned by the National Health Council.

1. Seventy-five per cent of those surveyed said they pay either a "moderate amount" (50%) or a "great deal" (25%) of attention to medical and health news reported by the media.
2. The primary sources of health news listed by respondents were television (40%), doctors (36%), magazines or journals (35%), and newspapers (16%). Interestingly, only 2% listed the Internet as a primary source.
3. Fifty-eight per cent said they have changed their behavior or taken some kind of action as a result of having read, seen, or heard a medical or health news story in the media. Forty-two per cent reported seeking further information as a result of media reports. Levi (2001) in her book describes medical reporter influences awareness, attitudes and intentions but may also

contribute to changes in behavior, health care utilization, clinical practices, and health policies. Media reports may influence what conditions are perceived as health problems requiring professional consultation and care. A systematic review of the best available scientific evidence in the field found that mass-media reports have a statistically significant and important impact on health services utilization. By featuring certain topics and excluding others, and choosing how to frame stories, the news media seem to not only reflect the public debate but also play an important part in setting the agenda, affecting public demand, and influencing the allocation of resources. In this respect, medical reporting is political.

Moeller (1999) states “Not since the Black Death has such mysterious evil visited England,” noted Newsweek, referring to the announcement in late May 1994 that 11 people in Britain has died from a virulent strain of group A streptococcus. The American media’s coverage of the “deadly bacteria” story bore all the stylistic hallmarks of their reporting on an outbreak of a deadly diseas– the story’s format, language, metaphors and images–resonated with American cultural history, folktales and myths. Fearsome similes were employed as a measuring stick to gauge the new threat. A couple of weeks of terrifying coverage and the media is on to the next crisis. But the method of coverage sets the bar higher for the next incident, the method trains Americans to want ever more sensational details, the method prompts the media to consider covering only the most threatening, most aberrant, most contagious epidemics. Those illnesses which merely kill in some pedestrian fashion – like diarrhea or measles – will garner no attention at all, and become, ultimately, the causalities of compassion fatigue syndrome.

Reed (2001) in his paper states accurate, accessible and informative reporting is a major concern of all science journalists and scientists, although they are interpreted differently. The continuing conflicts and tensions are located in historically constructed occupational identities, particularly that of the scientist as ‘modest witness’.

Shuchman (2002) states a 1997 survey of scientists found that the majority of them believed that reporters do not understand statistics well enough to explain new scientific findings, do not understand the nature of science and technology, and are more interested in sensationalism than in scientific truth. These concerns may have been bolstered by misleading reports in the popular press. Responsible reporting by journalists can illuminate important issues for the general public that might have otherwise remained obscured in the scientific arena. In some cases, investigative reporters have exposed aspects of medicine and medical science that prompted legislative and policy changes in the health care system.

Eggener (1998) in his paper states that there is a gap between the wealth of expanding information and the quality of public health, partly because of the difficulty of dispensing this information to the lay public. This ever-growing collection of information continues to influence the "wired" groups of society—the educated, wealthy, Generation X, and Baby Boomers—and has great potential for countless others.

Ransohoff and Ransohoff (2001) in their paper state sensationalism in medical reporting occurs when extravagant claims or interpretations about research findings are made. The conventional explanation for the problem is "miscommunication" resulting from the different styles of science and journalism, and the principal intervention proposed is "education."

Swine Flu

NDTV on April 29, 2009 reported according to the health ministry:

- A team of doctors and trained medical staff will be on standby at all the 9 airports
- Temporary quarantine areas are being set up inside the terminals where any suspect case can be isolated
- Along with the 24x7 call centers, they will take out ads in papers asking people to report any symptoms

In India the biggest challenge for the government right now is going to be preventing and tracking potential cases of swine flu entering the country through ports or international airports etc. But with lakhs of passengers coming into the country everyday screening each and every one of them is going to be quite a challenge.

The Hindu on January 25, 2010 in its article “Towards effective H1N1 vaccine” reported that the World Health Organization (WHO) is planning to review its response to H1N1 once the pandemic is over. Several European countries have accused it of exaggeration. The H1N1 flu virus began causing widespread outbreaks, but the pandemic turned out to be less of a killer than some virulent seasonal flu strains, people and governments are asking what the fuss was all about. The Parliamentary Assembly of the Council of Europe has now called for an investigation into the role of pharmaceutical companies in overplaying the dangers of H1N1.

The Hindu on January 2, 2010 in its article “Looking back on the pandemic” reported that 2009 saw the outbreak of a new influenza pandemic after an interval of 40 years. The first human cases appeared in April on the other side of the globe. Thereafter, in a world interconnected by rapid air travel, the new virus showed up in country after country. By June, the World Health Organization officially declared the start of the flu pandemic. The novel H1N1 strain has been quite unlike the one that set off the catastrophic 1918 pandemic.

The Hindu on December 22, 2009 in its article “Pandemic vaccine is safe” reported that the recent announcement by the World Health Organization that no serious and unexpected adverse effects have been seen in the nearly 65 million people who have been vaccinated for the 2009 influenza A(H1N1) in 16 countries is encouraging. The side effects -- swelling, redness, pain at the site of injection, fever, and headache -- were the common and anticipated ones; they resolved themselves spontaneously soon after vaccination.

The Economist on May 28, 2009 in its article “The origin of swine flu - Putting the pieces together” reported when a strain of influenza with pandemic potential struck in April, it was generally referred to as “swine flu” because it seemed similar to an existing group of strains, known as A/H1N1, which are commonly found in pigs. The World Health Organization and a number of European governments are now talking to manufacturers about expediting the development of such a vaccine and, on May 22nd, American officials announced a $1 billion scheme with the same goal.

The Economist on April 30, 2009 in its article “Pandemics - The pandemic threat” reported the new epidemic was raised on April 29th to just one notch below the level of a certified pandemic by the World Health Organization. In an effort to halt the spread of the disease, Mexico’s president, Felipe Calderón, has announced that non-essential services should close down between May 1st and 5th, and people should stay at home. But even if all the possible are counted in, a couple of hundred fatalities cannot compare with the 30,000 deaths caused in America each year by seasonal influenza. Either way, the authorities were right to hit red alert. Influenza pandemics seem to strike every few decades and to kill by the million—at least 1m in 1968; perhaps 100m in the "Spanish" flu of 1918-19. Kapoor (2010) reports that The United States of America have been the worst hit during the Swine Flu pandemic.

The threat of influenza is now being fought using the social networking medium to create more awareness about the vaccine. The Department of Health and Human Services (HHS) has initiated the campaign using a new Facebook application known as "I'm a Flu Fighter!" Basically this application will allow people to get an H1N1 vaccination and let others know that they are Flu Fighters now! An instinctive motive will urge others to follow their footsteps. Ben Reis, PhD, of the Children's Hospital Informatics Program said, "By leveraging existing social connections, people can spread positive health behaviors and attitudes amongst their friends and loved ones." On the Indian context, In.com, the portal from Network18 had launched a Swine Flu guide to serve as a reliable destination and keep the fatal disease away. This also helped pharma companies to reach their target audience and recommending the right vaccine through such platforms.

Kaul (2009) reports on his article "SMS GupShup Launches Swine Flu Community + Other Online Resources" that the social messaging platform, SMS Gupshup has established a community 'SWINEFLU'. The community has over 2100 member now in less than a week and sends out daily messages which include preventive measures, symptoms, tests, resources and real time news to its subscribers. At the same time it tries to debunk myths and baseless rumors. Members usually receive one SMS a day.

Mercola (2010) reports on January 25 the Parliamentary Assembly of the Council of Europe (PACE) will launch an emergency inquiry regarding the influence of pharmaceutical companies on the global swine flu campaign. The inquiry will focus on the drug industry's influence on the World Health Organization (WHO). The investigation is listed on the EU's draft agenda as "Request for Debate Under Urgent Procedure on 'Faked Pandemics – A Threat for Health'." Finin (April,27 2009) reports on "Twitter Swine Flu news: the downside" while we can use Twitter for news or reports on unfolding events from the field, it's a noisy channel. It seems that the flu-related tweets are arriving faster than anyone can read them.

WEBWIRE (January 24, 2010) published leading global market intelligence firm Synovate released data from a study examining the physician's view of the recent Swine Flu pandemic. The survey, interviewed physicians from the UK, France, Germany, Italy, Spain, USA, China, Taiwan and India about their views of the subject, revealed some interesting findings. The Asian markets seemed to be the most satisfied with their governments' reaction: 54% agreed that it has been well handled. In Europe, it is a rather different story with only 26% agreeing. Sixty-one % of all physicians surveyed felt or felt strongly that the media in their country has over-dramatized the swine flu outbreak. There were notable regional differences in opinion: 75% of respondents in the European markets agreed, 48% in Asia, and 46% in the US. Perhaps the most critical were the UK doctors with a huge proportion (82%) agreeing or strongly agreeing that the British media has over-dramatized the situation.

Research Methodology

The research method adopted for the study is survey method. This survey method helps to find the impact of health communication of swine flu among the target group especially women. This is purposive sampling method were the individual questionnaire is distributed to the respondents and collected. The sampling size of the survey is hundred. The samples are specified by the sex and educational status. The respondents are categorized into literate (fifty samples) and illiterate (fifty samples) women group for the survey.

From the results of the survey, the impact of health communication on swine flu is identified. The obtained results are comparatively analyzed with the theories and models of health communication to find the nature of the content of the persuasive messages by different communication campaign which tends to change their behavioral attitudes. And also helps to find the effectiveness of the communication among the women.

Findings and Discussions

The survey data are tabulated below to find the exact results. The different opinions from the literate and semi-literate group is collected and analyzed.

Awareness on swine flu

From the above arrived data it is understood that the 52% of the semi-illiterate groups have the awareness on what is swine flu and what disease is that? And nearly 48% of the same group had not much aware on swine flu. And 72% of the literate groups have awareness on swine flu and rest of the 28% of the respondents from the same group had not much aware on swine flu. It is understood that the environment for communicating about health issue has changed significantly due to the different status of the people including education and economic status. And moreover these changes also include by the dramatic increases in the number of communication channels and the number of health issues varying for public attention as well as people's demands for more and better quality health information. Communication occurs in a variety of contexts (for example, school, home, and work); through a variety of channels (for example, interpersonal, small group, organizational, community, and mass media) with a variety of messages; and for a variety of reasons. (Simons-Morton and Donohew et al, 1997). In such an environment, people do not pay attention to all communications they receive but selectively attend to and purposefully seek out information.

Awareness on swine flu vaccination

From the above arrived data it is understood that the 20% of the semi-illiterate groups have the awareness on swine flu vaccination and 80% of the same group had not much aware on swine flu vaccination. From the results it is able understand that the message on swine flu vaccination has not reached the semi-illiterate people. The form of message through different media communication has certain issues in communicating the illiterate group. And 76% of the literate groups have awareness on swine flu vaccination, in that almost 30% of the same respondents have vaccinated themselves and for their families, and 24% of the respondents from the same group had not much aware on swine flu vaccination. Clear communication and provision of updated information also helped to improve awareness and preparedness during the current pandemic (Harris, 1995)

Most useful medium in communicating information on swine flu

The collected data says that the most useful medium for receiving such information for semi-illiterate group is television medium which has 75% respondents and 13% goes to newspaper and 12% goes to radio medium whereas internet is not preferred by this group, though it targets most of the well educated people and other professionals. Among the literates 60% of the respondents prefer television medium and 15% newspaper and 5% radio and 20% preference to the internet for gaining information on swine flu. Health communication in particular media alone, however, cannot change systemic problems related to health, such as poverty, environmental degradation, or lack of access to health care, but comprehensive health communication programs should include a systematic exploration of all the factors that contribute to health and the strategies that could be used to influence these factors through different accessible medium. Increasingly, health improvement activities are taking advantage of digital technologies, such as telemedicine, internet and mobile communication engage people in interactive, exchange communication instantly. (street and Manning. et al, 1997). Despite the preference of media differs due to accessibility, affordability and educational status.

Persuasive messages helped to take any preventive measures

The data from the survey results that, 70% of the semi-illiterate group agreed that these communication message from the powerful medium influence to take preventive health measures on swine flu, only 30% of the respondents disagreed and said that these communicating message create distrustfulness. Sometimes susceptible health communication through media may not be believed by the people. The same way the literate group also responds to the question. Successful health promotion efforts increasingly rely on multidimensional interventions to reach diverse audiences about complex health concerns, and communication is integrated from the beginning with other components, such as community-based programs, policy changes, and improvements in services and the health delivery system.
(Simons-Morton, Donohew, and Crump. et al., 1997).

Analysis on theories of health communication impacts on behavior and practice

Over the decades the social scientists have advanced various theories of how communication can influence human's mind and bring changes in the behavior. The various theories and models provide communicators with indicators and examples of what influences behavior, and offer foundations for strategic planning, executing, and evaluating communication development (Piotrow and Kincaid. Et al., 1997), especially theories relevant to health communication include the following:

Protection Motivation Theory explains the influencing and predicting behavior of the communicated people. According to the persuasive communication by the media, the information about the disease created the pandemic among the people with an emphasis on the reach of information. This created a threat among the people with the cognitive processes of mediating behavioral change.

According to the theory, persuasive message on awareness of swine flu vaccination through television and print media reached the people with different perceptions towards the message. This leads to the response efficacy of the individual's expectancy that carrying out recommendations can remove the threat. Self-efficacy is the belief in one's ability to execute the recommend courses of action successfully. Hence the protection motivation is a mediating variable aroused the literate group to vaccinate, sustain and direct to protective health behavior, whereas the same message have not created much persuasiveness among the semi-literate group to vaccinate. (Boer, Seydel, 1996)

According to Roger E, 1975, Diffusion of Innovations Theory traces the process by which a new idea or practice is communicated through certain channels over time among members of a social system. The model describes the factors that influence people's thoughts and actions and the process of adopting a new technology or idea (Rogers,
1962, 1983). In this way communication on swine flu literally intrude to people's mind to react towards the preventive measures of the disease. The digital media and technology plays a major role in immediacy of communication targeting all segment of people.

Health Belief Model explains the health behaviors of the targets. The Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviors. This is done by focusing on the attitudes and beliefs of individuals towards the message on swine flu vaccination and health cause of the disease among the respondents of the survey. The model is based on the understanding that a person will take a health-related action like having vaccination for the swine flu, and thus it has a positive expectation that by taking a recommended action, respondent will avoid a negative health and believes that respondent can successfully take a recommended health action .(Glanz et al, 2002)

The Input/Output Persuasion Model (McGuire, 1969) emphasizes the hierarchy of communication effects and considers how various aspects of communication, such as message design, source, and channel, as well as audience characteristics, influence the behavioral outcome of communication (McGuire, 1969, 1989). In this the communication on swine flu influence the people by the message as wear face mask, close your mouth and nose while coughing and sneezing, medium source like television has attracted the audience with best advertisements on swine flu and news coverage.

Social Cognitive Theory explains the behavioral patterns of the people in the society. The Social Cognitive Theory is relevant to health communication. The social cognitive theory explains how people acquire and maintain certain behavioral patterns, while also providing the basis for intervention strategies (Bandura, 1997). Evaluating behavioral change depends on the factors environment, people and behavior. The situation refers to the cognitive or mental representations of the environment that may affect a person's behavior. The situation is a person's perception of the lace, time, physical features and activity (Glanz et al, 2002). The three factors environment, people and behavior are constantly influencing each other.

That adoption of a behavior is a function of intent, which is determined by a person's attitude (beliefs and expected values) toward performing the behavior and by perceived social norms (importance and perception that others assign the behavior). Social cognitive (learning) theory, by A. Bandura, specifies that audience members identify with attractive characters in the mass media especially they understand the target audience, it is differentiated with the style and format of the program content, like that who demonstrate behavior, engage emotions, and facilitate mental rehearsal and modeling of new behavior. For example, the television advertisement on swine flu communicates the message like people have to approach government health centers for check up and do test and take preventive measures, the visuals of a blind man going for the check up approaching the government health care centre and people of everybody includes other patients, nurses and doctors etc., applause the blind man this creates a visual appealing and emotional situation. The behavior of models in the mass media also offers vicarious reinforcement to motivate audience members' adoption of the same behavior (Bandura, 1977, 1986).

Social Process Theories: Social influence, social comparison, and convergence theories specify that one's perception and behavior are influenced by the perceptions and behavior of members of groups to which one belongs and by members of one's personal networks. People rely on the opinions of others, especially when a situation is highly uncertain or ambiguous and when no objective evidence is readily available. Social influence can have vicarious effects on audiences by depicting in television and radio programs the process of change and eventual conversion of behavior (Festinger, 1954; Kincaid, 1987)

Cultivation theory of mass media, proposed by George Gerbner, specifies that repeated, intense exposure to deviant definitions of "reality" in the mass media leads to perception of that "reality" as normal. The result is a social legitimization of the "reality" depicted in the mass media, which can influence behavior (Gerbner, 1973, 1977; Gerbner et al., 1980). Similarly people believe in television news and advertisements and announcements related to health communication. The credibility of the news in the channels brings the reality by the visuals and content of the coverage and the program.

Conclusion

Effective health communication is now recognized to be a critical aspect of healthcare at both the individual and wider public level. Good communication is associated with positive health outcomes, whereas poor communication is associated with a number of negative outcomes. Knowledge is a significant influence on attitudes and practices in a pandemic, and personal experience influences practice behaviors. Efforts should be targeted at educating the general population to improve practices in the current pandemic, as well as for future epidemics.

The study provides evidence on the correlation between knowledge, attitudes, and practices among two different exposure groups with similar health communication on swine flu. This has substantial implications for public health educators and planners in implementing pandemic preparedness plans. This shows that good knowledge is important to enable individuals to have better attitudes and practices in influenza risk reduction. (Maibach and Parrott, 1995).

Healthcare workers and communicators, educationist have had greater and more direct exposure to flu cases compared to the general population and this first-hand experience may have resulted in behavioral changes. This possibly reflects the effect of actual real-life experiences with flu on individual behavior among the literate group. It will therefore be important to determine solutions to instill the same level of positive behaviors in the general population like to illiterates and semi-literates without the need for prior infection or the personal experience such as being close contacts or healthcare workers. One possible solution would be the sharing and imparting of personal experiences to the general community through effective communication strategy with greater health messages in most accessible medium of channel. Theories and models of health communication define the communication process and strategic ideas of communication by defining the health messages. The content of the media differs according to the genre of the media. It's the prime duty of the media to educate the masses and help them to take informed decisions especially when it comes to health related issues.

Suggestions

The media should be self-regulatory and set itself a set of guidelines and standards to report health related issues. Media should understand its commitments to the society in times of such global pandemic crisis, as it serves as a primary source of information worldwide. It has to refrain from reporting sensationalized news stories, making public service announcement, forming communication content and employ more information value and elements of awareness in its health related articles. It can publish expert's views columns and more health features to dispel the public on myths and misconceptions of a disease. Media should make a responsible choice between spreading the word of caution, saving lives across the globe or instilling fear and panic victimizing the citizens.

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110. Design Implementation and Performance Comparison of ZCC code and MDW code for 10Gbps Optical CDMA System

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Abstract. OCDMA is an efficient method of optical communication in which Optical codes is used at transmitter end in order to encode the data and correspondingly it is decoded at receiver's end. Every user has a specific code through which it encodes the data and thus minimizes the error rate in the system. Here a comparison between the codes ZCC and DW is done. As these codes have a correlation value of either zero or close to the ideal value. In this research, we have designed a system to incorporate both these codes separately and analyse the performance on the basis of BER and Q-factor taking a 50km of fibre and sending the data at 10Gbps. Further, the results are analysed using eye diagram and signal diagram for both the above mentioned codes and it was observed that DW code support only 16 users whereas ZCC code supports 18 users with minimum BER as $^{e-9}$. The codes where constructed using MATLAB and implemented in Optisystem 7.0.

Keywords: Zero cross-correlation (ZCC), Double word (DW), Optical code division multiplexing (OCDMA), Multiple access interference (MAI), Optical communication, bit error rate (BER), Quality factor (Q-factor)

Introduction

The optical CDMA systems suffer from MAIs from other simultaneous users. As the number of simultaneous users increases, the bit error rate (BER) degrades because the effect of MAIs increases. In this method, our data is being encoded through time delays representing providing the necessary chip rate for the given code. Thus, similar time delay is employed at receiver's end in order to decode the incoming signal. Optical Fibre is used as a channel for sending information and thus, this type of communication is referred as OCDMA. All the data is sent through the same frequency but every user has a unique code through which data encryption is done and this reduces MAI, thereby supporting more number of users efficiently. In OCDMA system Phase Induced Intensity Noise (PIIN) is strongly related to MAI due to overlapping of spectra from different users [1]. Thus, ZCC codes and DW are compared in terms of BER and Q-factor for same number of users. Comparison is done between the eye diagram and signal diagram in order to find out which has a minimum MAI. The result is being simulated in optisystem7.0 for 50km fibre and 10Gbps bit rate maintaining the laser frequency at 193.1THz. This paper will follow the sequence given as under:-

In Section 2.0 code construction and properties are mentioned, Section 3.0 design of the system is being discussed and results is followed in Section 4.0

Code Construction

DW CODE

The DW code has a fixed weight of two. By using a mapping technique, codes that have a larger number of weights can be developed. Modified double-weight (MDW) code is a DW code family variation that has variable weights of greater than two [1]. Here we are not using MDW code because it has a code length more than that of DW code. So in order to make our system cost efficient we choose DW code rather than MDW code.

The proposed DW family can be constructed as follows:

This code is represented by using a matrix of size UxL where; U = number of users, L = code length.

The initial (basic) matrix for U = 2 and L = 3 is given as:

$$D1= \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

D2= $\begin{bmatrix} 0 & D1 \\ D1 & 0 \end{bmatrix}$ D2= $\begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}$ D3=

And likewise DW matrix is constructed.

$L = \frac{1}{2} U$ when U is even
$L = \frac{1}{4} U + \frac{1}{2}$ when U is odd

ZCC CODE

The ZCC code is derived from family of DW codes. The key to an effective OCDMA system is the choice of efficient address codes with good or almost zero correlation properties for encoding the source. The use of ZCC code can eradicate phase induced intensity noise (PIIN) which will contribute to better BER.

The proposed ZCC family can be constructed as follows:

This code is represented by using a matrix of size UxL, where U = number of users, L = code length.

The initial (basic) matrix for U = 2 and L = 2 is given as:

C1= $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

C2= $\begin{bmatrix} 0 & C1 \\ C1 & 0 \end{bmatrix}$ C2= $\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$ C3=

And likewise ZCC matrix is constructed.

$U = 2^{T}$; $L = 2^{T}$

Where T is the mapping process.

System Designing

Fig 1: Transmitter circuit

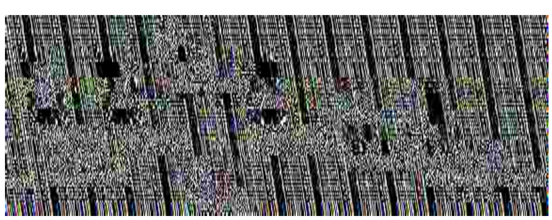

Fig 2: Receiver circuit

Bit Rate = 10Gbps
Time period of data = (1×10^{10}) ^-1 sec = (1×10^{-10}) sec

Table 1: System Parameters

Fibre Length	50km
Bit rate	
10Gbps Source Frequency	
193.1THz Attenuation	
0.2dB/km	
Filter cut-off frequency	0.75*Bit rate Hz
Dark Current	
5nA Number Of Users	
16	

Chip Rate = $\frac{(1\mathrm{x}10^{-10})\ \mathrm{sec}}{L}$

Time Delay = (Chip Rate) * (Y)
Where; Y = number of zeros sent in a coded sequence before a ‘1’.
Here to avoid complexity of system and making it cost efficient we minimum weight.
W = 1 (ZCC), W = 2 (DW).

Results and Discussion

It is evident from Fig 3(a) and 3(b) the major effect of MAI is on DW code as its eye diagram is not as wide as that of ZCC code when the fibre length is taken to be 50km and number of users are 16, data transmitting at the rate of 10Gbps. Here heavy weight codes are not included so that the designing of the circuit should be cost effective.

Based on the analysis of BER and Q-factor it is shown in the figure that ZCC is a better code having BER as (2.935×10^{-12}) and Q-factor as (6.86066) when U=16 compared to DW with BER as (6.8984×10^{-9}) and Q-factor of 6.03669.

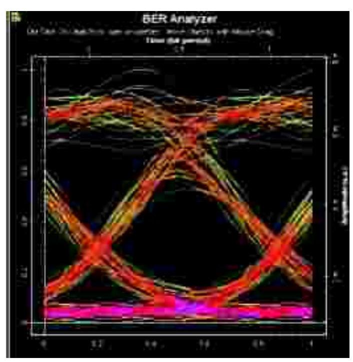

Fig 3(a):Eye diagram of DW code U= 16

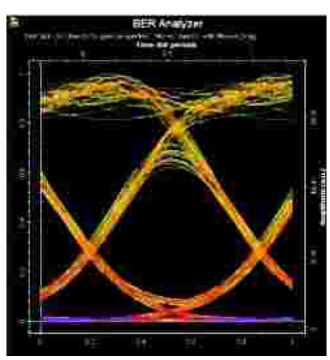

Fig 3(b): Eye diagram of ZCC code U=16

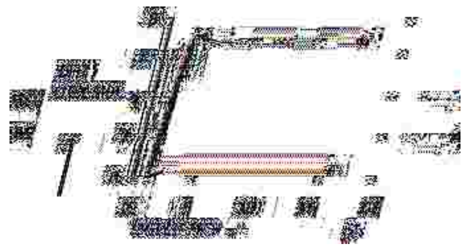

Fig 3(c): Variation of BER with increasing users

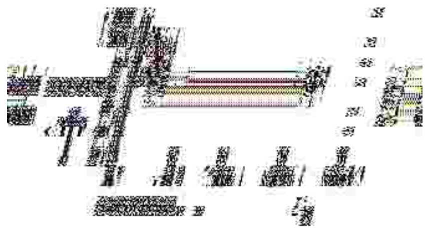

Fig 3(c): Variation of Q-factor with increasing users

It is more evident from the signal diagram that loss in signal is more in DW code as that in ZCC code and also the amplitude has fallen in DW code as a result of which the output received in DW code has more noise as compared to that of data encoded by ZCC code.

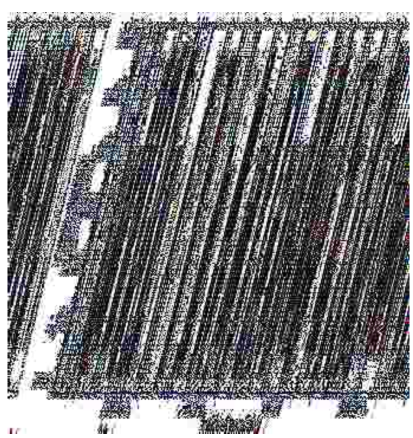

Fig: 4(a): Signal Diagram of DW code with U=16

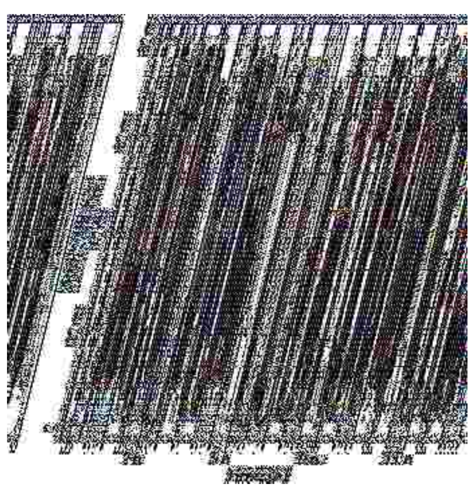

Fig: 4(B): Signal diagram of ZCC code with U=16

Conclusion

The OCDMA system so designed and implemented gives the result that ZCC code has a low BER of (2.935x) and high Q-factor of (6.86066) as compared to those results obtained from DW code with 10Gbps as the Bit rate and 50km as fibre length. This system supports about 16 users efficiently when DW code is applied and the users can extend to about 18 when ZCC code is used.

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111. Effects Of Neonatal Oxygen Deprivation In The Developing Brain: Relevance of Science Communication as a Preventive Action to Minimize the Effects of Anoxia and Promote Social Inclusion

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Abstract. Public Science Understanding is crucial to deal with Neonatal oxygen deprivation and the ensuing sequelae. It is a worldwide clinical problem that causes encephalic lesions in human neonates leading to serious and lasting consequences. Therefore, finding a suitable animal model to evaluate neonatal anoxia was our goal in order to address this multidisciplinary study under controlled conditions. The model was developed and validated by various procedures. After that, experiments were performed in control, basal and anoxia groups of neonate rats. The achieved results confirmed that neonatal anoxia in rats promotes long-lasting structural and behavioral effects. Therefore, conscious of the relevance of the neonatal oxygen deprivation in health and social interactions, we organized a course in the National Congress of the Brazilian Society for the Progress of Science. In this activity, the scientific findings were discussed in relation to the need of preventive actions along with mothers and health professionals. Moreover discussions on physical rehabilitation, education, accessibility and social inclusion were also approached. The analysis of the various items explored with the participants of the course, revealed that, in general, even in the academic level, this is a not well-known subject. Therefore, it became clear that to change this picture and offer better quality of life to those who are handicapped, a multi- and interdisciplinary science communication approach, involving various segments of the society, is necessary.

Keywords: science communication, public understanding of science, accessibility, oxygen deprivation, neonatal anoxia, developing brain, social inclusion

Introduction

The structural and behavioral effects of neonatal anoxia are part of a study in our laboratory, which involves students and collaborators from different institutions.

Oxygen deprivation might be experienced in different situations, but it is specially drastic in early life, when the nervous system is developing and the effects might be amplified with outcomes that could lead to lasting damage in motor and behavioral deficits in human newborns, among them are mental retardation, cerebral palsy, epilepsy, hearing and visual deficiencies (Rogalska et al., 2006; Majeed et al., 2007; Chen et al., 2007). Statistics data report that 2-4/1000 full-term infants suffer perinatal asphyxia, however this rate reaches approximately 60% in low-weight premature newborns, configuring an important public health concern (Vannucci, 1997; Laviola et al., 2004).

Therefore, finding a suitable animal model of anoxia was our goal in order to address this multidisciplinary study under controlled conditions, and search for interrelations between particularities of the ensuing sequelae and morph-functional changes. Thus, a model of neonatal anoxia in rats was improved from the literature, which comprises a semi-hermetic system suitable for complete oxygen deprivation. The efficiency of the model was confirmed by pulse oximetric assessment of peripheral arterial oxygen saturation, arterial gasometry, observation of skin color and motor behavior and also by proteins (S100beta and Fos) immunoreactivity analyses (Takada, 2009; Takada et all. 2010). Using this model in basal, control and anoxic groups of neonate rats we could confirm that neurons and glial cells were activated in respiratory neural control areas. Significant differences ($p<0,05$) in the proteins immunoreactivity in glial and neural cells were observed in the hippocampus of the oxygen-deprived animals in relation to control groups.

Interesting data were provided by behavioral tests performed with adult animals that suffered neonatal anoxia. Comparisons of the results of those three groups revealed that the animals of the anoxia group presented significant alterations in the following behavioral tests: spatial reference memory; working memory; sensory disturbance and anxiety and, also, acquisition of conditioned fear to sound and context (Ito, 2010).

The mentioned findings were discussed in relation to the background of the research group in science communication, physical and cognitive rehabilitation, accessibility, and social inclusion. Some doubts were raised: at what extent the academic and scientific communities are aware of the causes and mechanisms, and of the needs, of those who experienced neonatal anoxia? Which approaches would they propose to minimize the deficits and to promote physical social inclusion? Therefore, a course was elaborated and presented at the annual meeting of the National Society for the Progress of Science (SBPC- July 2010) in order to address these questions and explore, in a sample, the thoughts and involvement with the subject.

Materials and Methods

The proposed workshop was named: Neonatal anoxia: cell and behavioral alterations and its implications in public health, education and socio-cultural inclusion.

Its objective was to explore the comprehension of the problem by the participants, to contribute to a better scientific knowledge of the causes and mechanisms underlying the deficits that ensue neonatal anoxia, as well as to get a sense of their feelings on the situation of those who present disabilities. In addition, it was also aimed to improve the understanding, stimulate interdisciplinary research and the construction of a more fair and conscious society.

The activity was offered to 50 participants of the general community attending the meeting: teachers, graduate and undergraduate students in different academic areas. The program was scheduled for four meetings of two hours, during four days. There were selected subjects that were developed as oral presentations and discussions in groups. A workshop was developed with the attendees in which a participant would simulate visual, auditory or motor disabilities. Also, interactions between his/ her group, as caregivers, would be explored. The topics were:

Day 1: Brain structural alterations due to neonatal anoxia, etiology, animal models and their methods of research.

Day 2: Behavioral effects of neonatal anoxia in animal models and in humans. Day 3: Relevance of the public understanding of neonatal anoxia, its implications in physical and socio-cultural inclusion and the status of educational accessibility

Day 4: Strategies of interaction between patients and caregivers; expectations and possibilities.

The multidisciplinary group of researchers involved a senior neuroscientist, a physiotherapist and physical education professionals in the doctoral level from the Post-graduation Program in Morph functional Sciences (Biomedical Science Institute), and from the Neuroscience and Behavior Post-Graduation Program (Psychology Institute), a Psychologist (master level) a Linguistic (doctoral level) and a Science Communication Post-Doc researcher.

A previous evaluation was processed to verify the participants' knowledge and also their eventual experience with someone presenting physical and/or behavioral disability. A post-course evaluation was also done, in order to assess the participants' opinion on the topics approached, by answering some questions and by grading their satisfaction from 1-10. The data were analyzed and the results expressed in percentage of the attributed grade and the number of participants that were involved.

Results

The Congress was held in Natal, a city in the northeast region of the country. Forty-three participants attended the course; they were from various states of the mentioned region. Their background ranged from physiotherapy, nursing, education and business. The business students came by mistake or accompanying a friend. Among the attendees, four had a son or daughter who suffered from neonatal anoxia and were having troubles to follow rehabilitation due to the distance of the Health Centers. Only 37% had some knowledge on the proposed subjects.

Their interest in the issues approached in the course (table I), was mainly in the consequences of neonatal anoxia, followed by characteristics of anoxia; how to take care of persons with disabilities and in the social inclusion of persons with these conditions.

Table 1 Evaluation of interest in the approached issues

Item	%	Item	%
Consequences of anoxia	33,3	Prevention of anoxia and its consequences	1,9
Characteristics of anoxia	11,7	Activities with disabled children	1,9
Area of health and quality of life	9,8	Adaptations for people with disability	1,9
How to deal with disabled people	9,8	Neonates' conditions	1,9
Inclusion of people with disabilities	9,8	Thematic importance of anoxia to society	1,9
Animal models of research	3,9	Presentation multi-interdisciplinary approach	3,9
Visual impairment	3,9	Dynamics and experience of presenters	3,9

Table 2 Evaluation of knowledge improvement by approached subject

Approached issues	Percentage of participants by attributed grade, n=43						
	3	5	6	7	8	9	10
1 Neonatal anoxia characterization	-	2,3	-	-	7,0	18,6	72,1
2.Consequences of oxygen deprivation	-	-	-	2,3	7,0	25,6	65,1
3.Socio-educational communication policies	-	9,3	-	6,3	9,4	12,5	62,5
4.Methods to evaluate cognition and behavior	-	4,6	2,2	2,3	21,0	27,9	41,9
5. Relevance of inclusion of disabled people	-	-	3,1	6,3	25,0	28,1	37,5
6. Animal models used in research	2,3	2,3	-	7,0	23,3	27,9	37,2

Table 3 Evaluation of the Developed Program and used methods

Topics	Excellent	Good	Regular	Poor
5. Lecturer’s speech	79,1	20,9	-	-
3. Workshops	74,4	23,3	2,3	-
2. Thematic content and discussions	72,1	23,3	4,7	-
1. Lecturer’s experience	69,7	27,9	2,3	-
4.Movies	39,5	58,1	2,3	-

The participants considered that the course had a relevant contribution on their comprehension of the topics addressed, attributing themselves grades ranging from 8-10, most of them were graded 10 in the various items (table II). The most relevant topic was the characterization of neonatal anoxia, followed by consequences of oxygen deprivation and socio-educational communication policies.

Most of the participants considered excellent the lecturer's speech, program: schedule and content, and workshops (Table III). The short movies related to disabilities and lack of oxygen were rated as good and excellent.

Discussion

Although, some research reveal that certain achieved results in rats does not apply to humans (Demeter et al. 2008, Sarter, 2006, 2004), by moral and ethical principles, rats are still a good start to explore causes, consequences and strategies of some issues. The rat is the most widely used animal in experimental studies, due to their easily handling and housing conditions, for what they were chosen in this study. The stage of maturation of a newborn rat brain is comparable to that of a 24-week-old human fetus. A ten-day-old rat's brain is nearly at the developmental stage of a newborn human brain (Nyakas et al., 1996). Therefore, the periods of analysis employed are also an important aspect to take into account when establishing research correlations between these animals and human neonates.

Structural alterations were observed in brain areas of rats which suffered neonatal anoxia, this study is now looking for a better characterization of the phenomena (Takada 2009). Structural studies and behavioral test conducted in adult rats that experienced neonatal anoxia revealed that their performance was low than the ones of the control groups. These data confirmed the presence of the damage promoted in early life with lasting effects (Takada et al, 2010 and Ito, 2010). It was observed that their performance might be greatly improved as they go through repeated learning or training procedures (Ito, 2010). These data emphasize the importance of the frequency of therapy sections to suitable rehabilitation, but the public attending the SBPC- course reported difficulties to keep the frequency of treatment of their children because the rehabilitation centers are too far from their homes and also by the current changes in the schedule for making an appointment at the national health system (SUS- Single Health System).

Brazilian Institute for Geography and Statistics (IBGE – 2009) reports that about 24.000 Brazilians present some kind of severe disability. This rate is increasing, what demonstrates either a better system to report the cases or a worse condition of public health. In spite of very good rehabilitation centers, the difficulty to set an appointment with the sufficient frequency does not help the situation.

Science communication might improve the picture; this is the hypothesis that stimulated the offer of the SBPC-course. Actually, the results confirmed that this problem is not well known by the general public, in any of its aspects: causes, mechanisms, consequences, prevention and rehabilitation. Fortunately, the attendees enjoyed the program and reported the strategies and language as suitable for their comprehension, even by those not related to health area. The students from the business field acknowledged the positive effect of this course in broadening their understanding of disabilities. They now feel enabled to structure offices considering the biodiversity of human conditions Again, the workshop as practice of hands- hearts- and minds-on constitutes a useful tool to engage and stimulate participants to work on discoveries of new approaches and solutions to the problem focused (Nogueira et al.,2007, 2008, 2009). The interactions of simulated disabled persons and their caregivers showed that this problem has to be taken into account in all its aspects; the person himself/herself with strengths and weakness, the family, the health systems and both the physicians and therapists, but also the health centers administration. Moreover, the society comprising the educational, transportation and entertaining sectors should be prepared to shelter those in need.

The major problem in special education is not only physical but mainly social (Vigotsky, 1997). The increasingly isolation of handicapped children from collective experiences and different relationships has to be changed. In Brazil, the law empowers family, school and society committed to a school for everyone. However, in spite of the therapeutic pedagogy (Manton, 2005), the practice does not come well along with the theory. The pronounced difference of these children is just one more piece of data, in the plural and biodiverse universe we live in, emphasizing the essence of human being essence, his-her humanity.

One should ask: how can science communication make difference? The answer is: at all levels! A better understanding of causes/consequences can prepare relatives to look for medical advices when suspecting of problems with the fetus; those dealing with births can be more careful in many instances. The pediatricians should be more attentive at clinical examinations to early detect or correct problems. The comprehension by the disabled person of his/her condition can also help or stimulate to look for rights at all levels, to understand and collaborate in following rehabilitations protocols. Teachers, as multipliers of knowledge, can help the socio-cultural inclusion. Meanwhile society, as a whole, better instructed, might improve quality of life in general, by considering, and not forgetting, that we all, for some period, or at some time, might be disabled to some degree.

In summary, this experience was very positive for bringing closer the course's attendees and experimental research students in the problem; respectively deprivation of oxygen and lack of science communication, with knowledge gain for both. New aspects were brought, concerning disabilities and socio-cultural inclusion, to be discussed and worked on, but the relevance of science communication was emphasized in the construction of a better quality of life and a more fair society.

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III

Role of Science Museums, Science Centres, Planetariums & Science Cities

112. A General Research about the Role of Science Center and Science Museum—From the Perspective of Dealing with the Global-Warming Problem

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Abstract. As we all know, Climate-warming has become an indisputable fact, and this world-wide problem brings a series of serious results, such as climate change, the rising of sea-level and acceleration of glacier-melting, endless natural disasters and so on, which pose a serious survival challenge to all living things, including human beings. Climate-warming is a global problem, and it is the common challenge facing the whole people of the world, we have to attach a great importance to it.

This paper argues that, to deal with global Climate-warming, all the countries in the world need to act together, as for each individual, the most important point is to develop a low-carbon lifestyle, which advocated during the Climate Change Conference in Copenhagen in 2009.

Then, as the main place for people to get knowledge and attitudes about science and experience scientific research, what role should modern science center and science museum to play in dealing with this crucial and urgent global climate-warming?

This paper argues that, based on the above question, The modern science center and science museum should pay much more attention to help people understand and learn how to deal with climate-warming, not only just focus on the popularization of the knowledge of science & technology, scientific & technological achievements, and providing places for people to play interesting experimental games.

Modern science centers and science museums should establish a special area for climate-warming problem, where people have access to know the origin of climate-warming and what challenges it has posed to the whole world, it helps people realize the importance and the urgency for all countries to deal with climate-warming problem, it shows people the achievements which have been made in recent decades, it also introduce the main practices adopted by all countries in the world, The most important point is help people get knowledge about how to deal with climate-warming in everyday life, introducing low-carbon knowledge to people, advocating low-carbon lifestyle, help people develop low-carbon living habits in every detail of daily life and make contributions when it comes to the climate-warming problem.

Keywords: Science center and science museum, Climate change, Low-carbon

Science Center and Science Museum

Since it comes into being, the science center and science museum undertakes an important mission, which is popularizing knowledge of science and technology, advocating scientific methods, propagating scientific ideas and promoting the scientific spirits. And the traditional science center and science museum has been always practicing this mission, it emphasizes building scientific atmosphere, stimulating interest in science, it also attach a great importance to the exhibiting education, and the content of the exhibition mainly focuses on the concept and achievement of science and technology, including its influences on people's daily life.

But the roles of the science center and science museum in the whole world are not the same, they have different key points. Guangdong science center is the largest science -popularization base in Asia at the present, it is the platform for the exhibition, spreading and trading of scientific products, it also provides academic exchanges. Paris discovery palace in France gets the exhibition and the experiment together, it lays emphasis on inspiration and participation, and its purpose is helping people study during the exploration, and therefore improves their knowledge of science and technology. The San Francisco Exploratorium in USA focuses on the revelation of scientific principle; it emphasizes taking initiative as well as using both head and hand. The miraikan in Japan takes its position based on frontier science and advanced science; it mainly provides scientists a place for understanding of the latest scientific and technological developments. The science museum in Hong Kong focuses on the people's participation, it lets people have fun during the participation, it organizes high-quality exhibitions and interesting scientific programs, with the aim of popularization of science, besides, it helps schools carry out science and technology education. it also encourages people to find out the scientific principles through the operation of the exhibits, and let them experience the pleasure when exploring and studying science.

Based on the research of the roles of science centers and science museums in several countries or areas, we can draw a conclusion, that is, the traditional science center and science museum's main purpose is helping people get knowledge and experience the fun of science and technology, and this kind of running mode of science center and science museum is quite common, it focuses on the popularization and dissemination of scientific knowledge, it also emphasizes the mastery and application of science and technology, and the ultimate aim is promoting human's development, including the change of living style and the improvement of living standards, etc.

Roles of Modern Science Centers and Science Museums

As we all know, with the emergence and development of science and technology, the human's living and production style has been greatly changed, the progress of human civilization has also been speeded up, since that, people has mastered a better understanding of the nature, and then, people could make full use of the nature. Besides, with the knowledge of science and knowledge, people could adopt scientific methods to avoid natural disasters. But since stepping into the 20th century, the disasters human experienced and faced are more and more, and the natural disasters has become the major challenges for people, and they are even threatening the existence of all life in the world.

The natural disasters are the abnormal phenomenon in the nature, and they influence people's life from time to time. The damage caused by the natural disasters is usually frightening, and the loss is also very heavy. The common natural disasters usually break out suddenly, such as earthquakes, erupting volcanoes, floods, typhoon and tsunami, etc. Environmental disasters like ozonosphere changes, water pollution, soil erosion and acid rain, are produced by human activities. Besides, disasters, such as glacier melting, land desertification, drought, coastline variation and so on, develop its influence in a long time, and they do damage to human gradually. These natural disasters have a complex relationship with the environmental damage. Within the 21st century, the most important natural disaster the scientists discuss could be climate change. The rapid melting glaciers in gl Greenland, the frequent extreme heat in whole world are the serious consequences caused by climate change.

The occurrence of all these disasters existing in the nature are caused by the invincible natural factors, what's more, the factors produced by human activities could not be ignored. Then, as to these natural disasters, particularly the issue of the climate warming, is there anything we can do about it? When we make progress in science and technology and enjoy a better civilization, should not we adopt a scientific way to prevent or reduce the occurrence of these disasters?

The answer is yes, we have to get knowledge of these disasters occurrence and development from the scientific perspective, and then try to reduce the hazards, and it has become a common theme of the international community.

Dealing with these natural disasters, we need not only scientist to strengthen the scientific and technological breakthrough, but also the innovation of science and technology, what's more, we need everyone in the world take actions to combat the natural disasters, and use the scientific method and means to reduce the occurrence of disasters or damage caused by them.

Do people know how to combat natural disasters inherently? Do people know how to avoid damage caused by disasters inherently? No, when people get knowledge about these disasters, including the causes and the results, and learn how to do to avoid them, so that people could be free from all damages, or at least less.

There are different ways for people to get knowledge about the disasters, such as watching television, logging on internet, reading books and so on, but through these ways, people's consciousness of taking initiative to prevent and avoid disaster could not be stimulated, it also can't offer people a more powerful feelings towards disaster. To stimulate people's consciousness of taking initiative to prevent and avoid disaster, we must bring people a true sense of disaster and its severe consequences, etc.

The science center and science museum is a place where scientific knowledge is disseminated; it provides people a space to experience freely. Therefore, in order to offer people a more truly and powerful feelings towards disaster, the science center and science museum must take actions, it should not just hold the ideas of popularizing knowledge of science and technology, exhibiting scientific products, enjoying scientific fun and so on, the science center and science museum should show some scientific and effective methods to prevent and avoid disasters, as to dealing with climate change that concerns all living beings on earth, it becomes more urgent.

Climate Change: A Challenge for Human Society

The Copenhagen climate change summit held in September, 2009, has been considered as the most important meeting when it comes to the sustainable development of the whole world, it is also considered to change the fate of the earth. Thus, we can learn that how serious the climate change is for the survival of mankind. But at this summit, because of the interest conflict, the leaders of countries failed to reach an agreement on dealing with climate change; This means that the climate change will bring more harm to the whole world in the near future.

Then, what challenges the climate change brings to the earth? This paper expounds main some challenges listed as follows. First, is the global glacier melt. It causes a series of problems such as flood, drought, drinking water reduction and so on, these are the major issues related to human survival; Second, the extreme climate. Such as the blizzard, storms, hail, lightning, typhoons, and so on. The study shows that since the 1970s, the scope of drought has become broader, its duration becomes longer, and the result becomes more serious, particularly in the tropical and subtropical regions; Thirdly, the reduction of grain output. The global warming may lead to the instability of the agricultural production; problems like high temperature, drought, the pests may cause the reduction of grain output. Meanwhile, the rising of the temperature will expand the region where agricultural disease exists. Therefore, the influence on the crops will be worse, and finally leads to the increasing usage of the agricultural herbicides: Fourth, the rising of sea level. Due to the rising of sea level, various island countries are faced with problems like the shrinking of the land area, moreover, some island countries may be drowned. A survey shows, more than 70% people of the whole world live in coastal plain, among the 15 biggest cities, there are 11 located at the coastal area or the river mouth. once the sea level rises beyond a certain bound, people living in these areas will also face the danger of being drowned; Fifth, the extinction of species. The fourth assessment report released by the intergovernmental panel on climate change (IPCC) in 2007 points out that, in next sixty to seventy years, the climate change will lead to the extinction of a large number of species, as a member of the universe, may the human beings also be faced with this embarrassing situation one day?

The above five points are not just an alarming talk; they do exist in our daily life. If we don’t take actions, we may do have to experience this serious consequences.

As we can see, dealing with the climate change can not be delayed anymore. Then how to cope with the challenges brought by the climate change? What should we do? As to each individual, a consensus has been reached, that is reducing the disasters brought by the climate change, and the most important point is guiding people to develop a low-carbon living style in our daily life.

Modern Science Center and Science Museum vis-a-vis Climate Change

Generally speaking, the science center and science museum consists of several exhibition areas, which are designed for the different exhibits. Each exhibition area has a main theme, such as Science and Technology in daily life, Exploration and Discovery, Science Park, Future and Challenge. With a main theme in each area, people could feel more convenient to visit. Besides, most science centers and science museums have a temporary exhibition area, which mainly used to exhibit the latest technology, products or research results. But the science centers and science museums with the theme of dealing with the climate change is few, most science centers and science museums have no relevant exhibition area. It is not in accordance with the development of human society. the development of human society is the sustainable development of human civilization, it aims at increasing people’s living standards and improving the existing environment, and in order to achieve these aims, just relying on the scientific and technological progress is not enough, we should also need to reduce the violation of the nature as well as raise the ability of preventing and reducing disaster brought by the climate change.

After all, most people visiting science center and science museum want to learn science, get a better knowledge about science and technology, and then make full use of it so as to improving living conditions and environment. But various disasters brought by the climate change affect people’s life at any time, and it appears to be more frequent in recent decades. But people’s consciousness of dealing with the climate change is not strong enough, in fact, most people think that dealing with the climate change is just the responsibility of a country, and have nothing to do with each individual.

While, dealing with the climate change is the common challenge for the entire humankind, it requires the concerted action of the entire humankind. In this sense, setting up a exhibition area with the theme of dealing with the climate change is becoming increasingly urgent.

Then, how to design the exhibition areas with the theme of dealing with the climate change so as to attract people’s interest and let people take initiative to combat the climate change? This is an important but difficult issue. As we all know, such as driving cars once in a while, using less plastic bags, stopping cutting trees and so on, are the concrete actions for all individuals to combat the climate change, but taking these actions will inevitably affect people's lives, but if we don't do it, dealing with the climate change will be an empty talk.

Therefore, when designing the exhibition area with the theme of combating the climate change, the science center and science museum has to attach much importance to the aspects such as the exhibition area's designing, decoration, operation and so on. Let people have a shock from the bottom of the heart after visiting this special exhibition area, and help them give up the narrow consciousness of emphasizing personal interests and neglecting the existence of all humankind.

Then how to design the exhibition area with the theme of combating the climate change? The follow four aspects are strongly recommended to finish the layout. Relevant information on climate change has been introduced in the first part. When people talking about the climate change, the most direct understanding on it is the global warming, but where does the problem of global warming come from? What negative influences it brings to us? And how do these influences effect all the living things existing on earth? As to these questions, they do not know. While if they do not know the basic knowledge about the climate change, they will not take any action to combat the climate change. to be more strict, the global warming will be further increased. Therefore, introducing some relevant information on climate change is rather important. At the beginning of the exhibition area, the knowledge about the climate change should be introduced through texts, pictures, figures. The main text should include the origin of the climate change, but the written language should not be excessive, otherwise, people will neglect this part for the long texts. Some pictures may be added in appropriately, these pictures should be real and close to people's life, only in this way, people can be shocked after visiting. The numbers referred should be accurate and surveyable. In short, people's interest in climate change should be stimulated as much as possible in this part, and let them think that the problems caused by the climate change are closely related to everyone.

After introducing the relevant information on climate change, it is necessary to assume some circumstances if the problems of climate change aggravates and what might happen to the survival environment of humankind. That means simulating the survival situation after the global climate changes. In this part, much more attention should be paid to people's feelings. Designing a simulated environment, such as the increased temperature, with the aim to reinforce people's feelings of the impact brought by the climate warming, and therefore, help people recognize the responsibility and urgency for combating the climate change and take actions more consciously to protect our homeland.

Since people visiting in the science center and science museum, it is essential to introduce the research result of combating the climate warming by scientists to visitors. In this part, the exhibition content should be provided as rich as possible, including the latest research results and the efforts paid by the scientist, such as the development and application of new energy. In addition, some international conferences on global climate change as well as policies and measures adopted by the governments may be also introduced in this section, let people know that combating the climate change is not just the task for scientists and governments, everyone has the responsibility to join in this meaningful action.

The last part is the most important part. In this part, knowledge about combating the problems caused by the climate change in daily-life should be introduced to people with detailed presentation. the content of this part should be close to people's life, it may be classified according to people's eating, clothing, housing and move. As to eating, it is necessary to advise people don't eat those precious, rare or endangered animals and plants, so as to keep the ecological equilibrium and maintain the biodiversity. As to clothing, it is necessary to recommend people choosing clothes made of cotton, linen and silk, for they are not only green and durable, but also fashionable and elegant. As to housing, emphasis should be put on conserving water, saving electricity and avoid energy waste. As to move, it is essential to advocate green traffic ways, green and energy-saving policy should be also promoted, such as no driving or less driving.

In short, introducing knowledge about how to combat the disasters caused by the climate change in daily-life to people is quite significant for science center and science museum at present, it is also of great urgency for science center and science museum to help people form good habits and lifestyle so as to dealing with the global climate change.

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113. Museums for Biodiversity Conservation and Environment Education

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Abstract. Public consciousness about biodiversity and the environment, and their importance for sustainable development is not so widespread in India. This article focuses on non formal environment education through nature interpretation centres and science museums. Information is provided about the potentiality of museums in providing recreation-cum-education to the general people and children. Some universities have small museums, botanical gardens, and other biodiversity exhibits for instruction and research, but these and the few zoos and wildlife centers are poorly funded or managed.Environmental problems like pollution, population explosion, deforestation, natural calamities, destruction and poaching of wildlife, overuse of pesticides all need serious attention. People are generally unaware of the importance and significance of the surrounding environment due to illiteracy and lack of education. For school children, Environmental Education has been regarded as a compulsory subject uptil the senior level. Even Environmental Education is a subject of Graduation. But it is doubtful whether the students are really learning to protect the environment and work for its preservation or just learning it by heart to score in their exams. So, theoretical learning is not at all fruitful until supplemented by use of all five senses. In the context of globalization and rapid advancement of technological arena, Museums should take the challenge of preserving the environment. Creating Environmental awareness will not only be beneficial for the society, but at the same time museum will too be benefited. For environmental degradation in form of pollution is harmful for museum buildings and objects. Environmental education seeks to empower individuals with an understanding of environmental problems and the skills to solve them. Besides the traditional role of documenting and displaying, educational programmes, a Science Museum and Natural History Museum can take up challenges of implementing and inculcating the environment awareness to all target groups.

Keywords: Biodiversity, Conservation, Environment Education, Interpretation centre, Sundarban,

Introduction

Plant and wildlife resources are of great economic as well as ecological importance. Each species is unique and irreplaceable. Every species is of scientific interest and makes some contribution to its ecosystem. However millions of species are disappearing from our earth. In the recent time, the rate of species extinction has gone up alarmingly high and is a matter of great concern. Taking into account the fast disappearance of Biological species, the year 2010 has been designated the International Year of Biodiversity by United Nations General Assembly so as to send the message of the need of Biodiversity conservation in a global perspective.

In today's world, the "natural habitat" of people has become the built environment where children spend on average 90% of their time (Stephen Kellert, Yale School of Forestry, Lecture in the San Diego Natural History Museum). So strategies need to be developed for a strong connection between the natural and built environments.

Many attempts have been made to bridge the gap between nature and layman. Attempts have been made through books, magazines, television programmes and school curricula. But such attempts will not be fruitful unless the theoretical knowledge are supplemenred by props- that is interactive way by which people can make themselves feel to be a part of the surrounding environment. There is need for an environment in which people can become familiar with the details of biological diversity and environment and gain some understanding by watching nature and various plant and animals behaviours.(Frank Oppenheimer-University of Colorado, November 1968).

Of the different types of Science museums, Nature Interpretation Centres can form a strong link in connecting nature with man. Interpretation Centers are buildings generally located at the place of interest that is an ecologically rich zone, nature reserve, etc. for dissemination of knowledge and information of the site through different exhibits. They are specialized for communicating the significance and meaning of natural or cultural heritage and serve for education and awareness. Visitors or tourists need to consider the visit to the interpretation centre as a part of their work before visiting the respective ecologically important site. The Environmental Committee of the American association of Museum, 1971 states: "Museums have seldom applied their influence to public issues: but the time has come when these institutions, which through the years have preserved man's treasures and nourished his spirit, must also apply themselves to the preservation of an environment fit for life". One of the thrust areas that pose a challenge to museologists is Environment. Presently, there is a growing concern throughout the world about the alarming condition of our environment.

Objectives

The present paper elaborates on the role of some Interpretation centres within West Bengal, India and how they communicate the importance of biodiversity conservation. The museums or Interpretation Centres under survey centres on the existing biodiversity of Sundarban National Park, 24 Pgs (S), West Bengal. The rate of biodiversity loss is increasing and we need to act now to significantly reduce it and remove this global extinction crisis. Our lives are inextricably linked with biodiversity and environment and ultimately its protection is essential for our own survival.

Area of study

The Sundarban comprising the largest mangrove cover in the world and Bengal's only Natural Heritage Site (as recognized by UNESCO) boasts of its importance in sheltering some of the endangered and critically endangered animals of the world. The Estuarine crocodile (Crocodylus porosus Schneider), forming the topmost consumer of the Aquatic Food Chain of the Mangrove ecosystem is one of such endangered reptiles. But in the recent past, the number of naturally reared crocodiles has decreased in number. Estuarine crocodiles form a very important part of the mangrove ecosystem. Any decline in the Crocodile population can cause tremendous impact on the primary and secondary consumers of the Mangrove ecosystem.

So, in order to restore the crocodile population, Forest Department of West Bengal has initiated a site for Breeding and rearing of these majestic estuarine reptiles in captivity at Bhagabatpur, 24 Parganas (S), followed by the release of the matured crocodiles back into their natural habitat, i.e. the tidal creeks of Sundarban. If one takes the chance of visiting the site, he or she may be able to get a clear idea about the birth and nurturing of baby crocodiles, their food habits, their gaining of maturity and final release into the estuaries. To supplement the living reptiles, an Interpretation Centre has been set up adjacent to the Breeding site. Visitors visiting this site should feel fortunate to come across such an informative resource centre. Within the Bhagabatpur Crocodile Breeding Project, an interpretation centre had been established adjacent to the breeding zone for creating awareness on crocodiles and floral and faunal heritage of Sundarban.

Methodology

Other museums involving Sundarbans include the Nature interpretation centres at other islands of Sundarbans which include Bonnie Camp, Ajmalmari Block, Sajnekhali and Bhagbatpur. Field visits were made and various literatures were consulted and correspondences with Forest Department made to gather information about the various activities of the Museum.

The data collected through the questionnaires were supplemented with additional data from semi structured interviews conducted immediately after the visit. Comparison was made with other leading Natural History museums in India.

Observations

The following observations were made during visit and survey of Bhagabatpur Interpretation Centre, Sundarban, 24 Pgs (S).

The entry point to the Breeding Project area bears some of the notable signage as mentioned below:

1. List of common flora in the Protected Areas, i.e. Lothian and Haliday Wildlife Sanctuaries of Sundarban. This includes true mangroves, mangrove associates, back mangroves as well as a few associated non-mangroves, thus highlighting the floral heritage of Sundarban.
2. A display board mentioning about the Do-s and Don't-s for the visitors. The instructions are written both in local language, ie. Bengali as well as English and clearly makes even a layman aware of the basic rules that are to be maintained within the breeding project area.
3. One of the Display board requests the visitors to pay a visit to the Interpretation Centre, at the entrance of breeding place for information on wildlife. So from the entry point itself, an indication is there to pay a visit to the Interpretation Centre suggesting there might be something valuable to gain from the Centre.
4. Request to the visitors to sign in and leave their comments in the Visitor Register. This is very important for it

is an aid through which the authorities can evaluate the effectiveness of their communication and awareness on the heritage of Sundarban. The dense growth of some mangrove species like Garjan (Rhizophora mucronata), Gneoa (Excoecaria agallocha), Kankra (Brugueira gymnorrhiza), Avicennia sp., Hental (Phoenix paludosa), Golpata (Nypa fruticans), Heritiera fomes (Sundari), Hargoja (Acanthus ilicifolius), Nona jhau (Tamarix dioica) and the mangrove fern Acrostichum aureum (Hudo) surrounding the breeding project as well as the Interpretation Centre are a feast to every visitor's eyes.

Near the entry point of the Interpretation Centre, there are display boards portraying the following themes:

1. World distribution of Crocodile, Alligator, Caiman & Gharial- which gives an impression of the distribution pattern and types of crocodiles across the world including the number of species.
2. Another interesting display is the "Salient features of Estuarine crocodiles". This indeed gives an overall impression regarding the external or identifying features by which we can identify an estuarine crocodile from other members like gharial and alligator. So one can note down the characteristic features and compare them with the live specimens. This will increase their power of observation of the morphological features of the crocodile hatchlings, which they could have missed had they seen the hatchlings without noticing the display board.
3. One display board gives an idea of the overall captive breeding procedure by means of flowcharts.
4. Once again, the ways of alerting people about the do's and don'ts of visiting the breeding centre is highlighted in a very lucid way.
5. The colorful pictorial depiction of the Food web prevalent in the mangrove ecosystem where crocodile forms the topmost of the food chain is of special interest to children and students.
6. A statistics of the success of the breeding of Estuarine crocodile in Bhagabatpur and around the world have also being displayed.

Display Technique of exhibits within interpretation centre

The Interpretation centre comprises of a large single Hall displaying various exhibits and specimens as listed below:

1. Preserved Specimens: As one crosses the entrance, he or she will inevitably be attracted towards the different stages of crocodile hatchlings starting from the large ovoid creamish white eggs. The eggs and crocodile hatchlings have been preserved within a chemical preservative-Formaldehyde. The labeled jars are kept at different levels for better viewing by the visitors.
2. Model: To notify the location of the island and the Breeding Project in particular, a 3D Model of the map of Sundarban have been kept well lighted.
3. Photographs:
   - The entire wall displays a large number of enlarged photographs on different stages of capturing of the mature crocodiles from breeding centres and their release into the various tidal creeks of Sundarban.
   - (Besides the estuarine crocodiles the floral and avi-faunal diversity of Sundarban have been portrayed through such enlarged photographs.
   - Enlarged photographs of general themes such as honey collection, fishing, agriculture, prawn seed collection also add to the display. Thus the socio-economic aspects of Sundarban have also been portrayed.
4. Laminated posters: Enlarged laminated illustrated posters on important flora and fauna of Sundarban, List of endangered, rare and extinct fauna of Sundarban, Prey species of Sundarban tiger and Ecodevelopment activities have been portrayed.
5. Sketches: Black and white labeled sketches showing distinguishing features of tongues of estuarine crocodile, marsh crocodile and alligator forms an added attraction.
6. Charts: A chart displaying the origin and evolution of reptiles is very interesting as well as informative
7. Map: A map portraying the wildlife of India is a source of added information to all types of visitors, especially wildlife lovers.

Analysis

Till date, various local schools, including a Blind Boys school have visited the interpretation centre and have immensely enjoyed their visit as evident from their remark on the Visitor Register. Research scholars from different universities visit the Breeding Centre quite often. General visitors, tourists and foreigners throng the breeding centre during the pleasant winter season. Tourists from Lucknow, Germany, Spain, Canada, and U.S.A have visited the entire complex, i.e. breeding site as well as the Interpretation Centre.

The Interpretation Centre at Bhagabatpur has thus being quite successful in reaching out to people, not only regional, but also at global level. However, more of publicity through educational awareness programmes, outreach programmes and most importantly developing popular as well as some scholarly publications will definitely enhance its success rate. Setting up of such a valuable Interpretation Centre in the rural area of Bhagabatpur, taking into consideration the dependence on solar power and adverse climatic conditions is indeed praiseworthy. Visitors will be enriched about not only the endangered crocodiles, but other important flora, fauna of the mangrove ecosystem.

Conclusion

Thus, it is seen that a Nature Interpretation Centre should not only highlight environment through its exhibits, but also device different communication techniques, which preferably centres on burning issues of today. In the fast changing world, where environment is at stake, a museum professional should rightfully consider Environmental degradation as an issue to be given due importance through the public. According to the keynote address delivered by Director General, Natural History Museum, Vienna, at NATHIST meeting, 20th August 2007, "… the major concern of the museum of Natural History is to take care that nature will not become history. Busier than ever all museums are collecting, conserving and defending cultural and natural values on an overpopulated planet, where the human race is to be blamed for mass-extinction of plants and animals, the rate speeding up to a thousand times the natural extinction rate in evolution…." So, environment awareness and conservation of Biodiversity is one of the challenges to be taken up by Nature Interpretation Centres to prevent nature turning into history.

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114. The Analysis Study of Chinese Public Attitudes Towards Science and Technology from 2010 Civic Scientific Literacy Survey in China

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Abstract. China Association for Science and Technology launched 8th Chinese civic scientific literacy survey, which was the largest survey in history with the sample size of 68416. The survey measured the Chinese public attitude towards science and technology through a battery of statements on science, technology and environment to which respondents were asked if they agreed or disagreed. The purpose of this paper was to investigate the Chinese public attitudes towards science and technology. Through the data analysis we obtained the status of Chinese public attitudes towards S&T and came up with suggestions on how to promote the public having the correct image of science and technology.

The findings of the study are: (1) Most of the Chinese citizens keep a positive attitude towards science and technology. The views of Chinese on the wider effect of science and technology on society are also positive especially the effect of science and technology on the work and human health. (2) Most of the Chinese citizens show their support to basic scientific research and they agree that scientists should participate in science communication to get people to know more about the new development of science research. About experiment animals, more than a half of the respondents in China agree that scientists can be allowed to use animals to do experiments like dogs and monkeys if they can produce new information about serious human health problems. (3) When asked about the effect of science and technology on environment, we find a public divide in attitudes held by Chinese citizens. (4) The opinions of Chinese citizens and EU citizens differ greatly. Chinese citizens hold more positive attitudes than the European citizens towards S&T. (5) Highly educated citizens have clearer cognition about the benefits and limitations of science and technology on human beings and society comparing to lowly educated citizens, and also are more rational. (6) We should put more efforts to investigate the factors affecting the attitudes towards science and technology and to improve the public science literacy.

Keywords: Attitudes, science and technology, scientific literacy survey

Introduction

The 8th Chinese Public Attitudes towards Science and Technology survey was accomplished by China Association for Science and Technology recently in 2010. China had its first survey of the sort in 1992 and the target citizenry was framed ever since at an age range between 18 and 69 in mainland China. Abundant data and research results were obtained during the last 18 years. Questionnaires used in the subsequent surveys were progressively amended by taking into consideration of both the international common items and the Chinese characteristic context.

Methods

The sampling size of the 8th survey hit 69, 360, and 68,416 valid responses were eventually collected, being the largest one ever known. Stratified three-staged PPS non-random method was adopted in sampling process, and visits of respondents were performed through indoor interviews. The obtained data was processed via multivariable non-linear joint weighted method. Gender, age, education and rural or urban are the four statistic variables involved in data processing. The survey measured the Chinese public attitude towards science and technology through a battery of statements on science, technology and environment to which respondents were asked if they agreed or disagreed. The purpose of this paper was to investigate the Chinese public attitudes towards science and technology. Through the data analysis we obtained the status of Chinese public attitudes towards S&T and came up with suggestions on how to promote the public having the correct image of science and technology.

Results and discussions

Most of the Chinese citizens keep a positive attitude towards science and technology. When asked whether

Science and technology make our lives healthier, easier and more comfortable, 89% of Chinese agree. There are 78% of Chinese citizens who agree that scientific and technological development will create more jobs than they will eliminate. They also in majority feel positively that thanks to science and technology there will be more opportunities for future generations (85%). The views of Chinese on the wider effect of science and technology on society are also positive especially the effect of science and technology on the work and human health. About the effect of science on people's health, there are 77% of Chinese citizens agreeing that scientific and technological progress will help to cure illnesses such as AIDS cancer. 75% of respondents agree that the benefits of science are greater than any harmful effects it may have. From this we can see that most of Chinese public feel positively to the science.

Chinese public hold positive and supportive attitude towards scientific and technological research. Most of the Chinese citizens show their support to basic scientific research and they agree that scientists should participate in science communication to get people to know more about the new development of science research. About experiment animals, more than a half of the respondents in China agree that scientists can be allowed to use animals to do experiments like dogs and monkeys if they can produce new information about serious human health problems. Most of Chinese agree that scientists should participate in science communication to get people know more about the new development of science research (75%). Majority of respondents support the scientific research even if it brings no immediate benefits (71%). About the animals experiment, 63% of Chinese citizens agree that scientists should be allowed to do research that causes pain and injury to animals like dogs and monkeys if it can produce new information about serious human health problems, while 44% of EU respondents agree with the statement. As a whole, we can see that Chinese citizens keep supportive to science research.

When asked about the effect of science and technology on environment, we find a public divide in attitudes held by Chinese citizens. When asked whether technological discoveries will eventually destroy the earth, 23% of Chinese agree, 35% of respondents disagree. It should be concerned that there are 23% of respondents said that they don't know about the point and about 20% of respondents report that neither agree nor disagree. 36% of Chinese citizens do not agree that science and technology advances will allow the Earth's natural resources will be inexhaustible. Only 28% of respondents agree with the statement.

Most of the Chinese public hold rational attitude towards science and technology development. Nearly one third of Chinese respondents (32.7%) totally agree that' the benefits of science are greater than any harmful effects it may have', and 42.1% of respondents tend to agree. Concerning the impact that science and technology may bring to environment, more than a half of respondents (57.2%) believe that' technology application will have both positive and negative effect on environment'. A small number of Chinese public have over-positive attitude to science and technology development. Most Chinese citizens do not agree that 'science and technology will make the Earth's natural resources to be inexhaustible'. Only 13.4% of respondents agree with the statement. Few Chinese respondents hold negative attitudes to science and technology development. Less than one tenth of respondents (8.0%) totally agree with the statement that 'constant application of technology will eventually destroy the earth'. Only 5.4% of respondents totally agree that 'even without S&T, people can live very well'. (Figure 1)

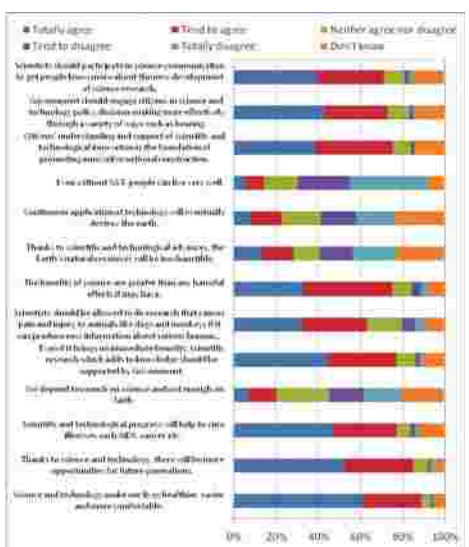

Figure 1. Chinese public attitudes towards science and technology

Conclusions

From above findings, we can make conclusions: (1) Most of the Chinese citizens keep a positive attitude towards science and technology. The views of Chinese on the wider effect of science and technology on society are also positive especially the effect of science and technology on the work and human health. (2) Most of the Chinese citizens show their support to basic scientific research and they agree that scientists should participate in science communication to get people to know more about the new development of science research. About experiment animals, more than a half of the respondents in China agree that scientists can be allowed to use animals to do experiments like dogs and monkeys if they can produce new information about serious human health problems. (3) When asked about the effect of science and technology on environment, we find a public divide in attitudes held by Chinese citizens.

(4) The opinions of Chinese citizens and EU citizens differ greatly. Chinese citizens hold more positive attitudes than the European citizens towards S&T. (5) Highly educated citizens have clearer cognition about the benefits and limitations of science and technology on human beings and society comparing to lowly educated citizens, and also are more rational. (6) We should put more efforts to investigate the factors affecting the attitudes towards science and technology and to improve the public science literacy.

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115. Do Science Communication University Programs Equip Students to Become Professionals? A Comparison of 20 University Programs Worldwide

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Abstract. During the 10th International PCST conference in 2008 the states of science communication curriculum worldwide was one of the items in a workshop on science communication curricula. However, there remains much to be explored and discussed, especially how science communication programs present to potential students the relation between the curriculum and profiles of science communicators. In this research, twenty science communication master programs worldwide are investigated and compared for a better understanding of how the curriculum equip students to become professionals.

Keywords: Profiles, Science communication curriculum, Professionals, University programs

Introduction

Science communication is a new and emerging discipline. In Science Communication, an emerging discipline (Trench, Bucchi, 2010), one of the conditions mentioned for an established discipline is a bounded field of study with significant presence in teaching and research in the higher education sector. Science communication is a field of study that has been growing and developing over the last 20-30 years, integrating professional activities and established studies, for example disciplines such as science education, social studies of science, mass communication, and museology, etc. Simultaneously, the specialization of science communication professional is also growing. For a multi-disciplinary and interdisciplinary discipline, organizing the core knowledge for the study would be challenging
(Priest, 2010). In Mulder's model (Mulder et al, 2008), the four areas of study in science communication are defined: science, social studies of science, communication studies and educational studies. There is already a lot of existing science communication programs worldwide with very different program objectives, curricular structures, and descriptions of the profiles of science communicators. This makes it very hard for potential students to grasp how the structure and content of the curriculum relate to the professionalism of science communication. Although university master programs do not aim at vocational trainings, it is still very important for the students to see in which aspects the curriculum prepare and equip them to become future professionals.

By taking twenty science communication university master programs worldwide as examples to provide a descriptive current overview, the main research question asked in this paper is: Do science communication university master programs equip students to become professionals? Two sub-questions are also proposed: How are the program objectives related to the profiles of science communicators? How are the programs structured to equip students to become professionals by relating the content of the study to the profiles?

Methods

The research is based on online information from twenty science communication university master programs worldwide, including 3 programs from the Netherlands, 3 from the United States, 2 from England, 2 programs from Australia, 1 from Brazil, Canada, France, Italy, Ireland, Japan, Korea, Mexico, New Zealand, and Spain. The programs are chosen from different countries to present the worldwide overview. Accessibility and availability to the websites of the programs are also prerequisite for choosing the programs. Three steps are taken to conduct the research:

Step1: Data collection

Descriptions of the profiles of science communicators and other general information provided on the websites are collected to get an overview of the current status of science communication university master programs worldwide.

Step2: Categorizing

The lists of courses in each program are categorized into the four areas of study for science communication (Mulder et al, 2008): science, educational studies, science and technology studies, and communication studies. In this research, subcategories are made in each study to get a clearer view on the detailed contents of the curriculum and on subjects which are the main focuses in each area of study. For the area of 'science', it is divided into two parts. The 'hard science' indicates courses such as natural science or engineering subjects. 'Science as contents' indicates that the course is designed to integrate scientific issues into the other three areas of study. For communication studies, three subcategories are made, with focuses on media skills, design or media studies. In the area of social studies of science, subjects such as history of science, societal and technological issues, philosophy of science, ethics, and science policy belongs to this part. For educational studies, courses that aim at informal learning, psychology, or didactics fall into the category. The internships and research projects in the programs are also analyzed by looking into the contents.

Step3: Linking the science communication curriculum with profiles

The last step tries to connect and compare the information gathered in step one and two to investigate the relations between the curriculum and profiles of science communicators. The model of professional positions and the corresponding areas of science communication study is applied (Mulder et al, 2008) to investigate the link. The profiles of science communicators are portrayed by the combinations from the four areas of science communication study, as shown in figure 1.

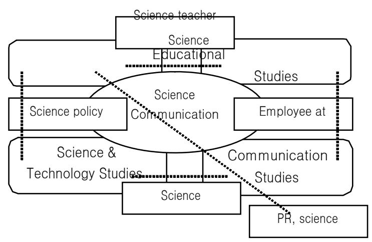

Fig. 1 Professional positions and the corresponding areas of science communication study

Results

The Objectives of the Programs

There are some similarities in the objectives of the programs, in which the importance of integrating theory and practice are stressed, and also the goal for students to gain competences in developing communication strategies, application of media in the social context. However, there are more differences than similarities in the objectives. Some programs aim at more specific objectives or USPs (unique selling point). For example, in Brazil, State University of Campinas, the main objective is to train researchers and journalists who are able to dedicate themselves to a more in- depth study of scientific and cultural communication. In New Zealand, University of Otago, the focus is on popularizing science: making science fun, sexy and easy to understand. University Pompeu Fabra in Spain organizes the curriculum in three modules: scientific communication, medical communication, and environmental communication, and the science communication program at Drexel University in the United States targets students who aspire to medical, science and pharmaceutical writing.

Professional profiles

Most programs provide descriptions of possible future science communication careers on their websites but only give a general list of the professionals. The most mentioned ones are communicators at science centers, PR, science journalists, science policy advisors, consultants, etc. Some programs give a more detailed description of the professionals. TU Delft in the Netherlands lists the career prospects for science communicators in six different positions by giving examples of the activities performed. In the description of 'science communication manager', it states that "communication managers are charged with the control, direction and coordination of the communication processes within and from companies and organizations." Also, some programs have different ideas about categorizing the profiles.

Background of the students

Only 7 out of 20 programs require students with a bachelor degree in science/engineering while the rest target student from both natural and social sciences. A few programs also include professionals, for example, in Brazil, State University of Campinas, students come from different academic trainings, including graduates, senior professors, engineers, journalists, natural and social scientists. In Japan, the science communication program in collaboration with CoSTEP at University of Hokkaido aims at training students as well as personnel.

Length of the Programs

Ten programs are one year programs while the rest are two year in length. Four out of twenty programs provide students the possibility to conduct a part-time study.

The four areas of science communication study

Each program contains at least two areas of science communication studies, mostly a combination of communication studies and social studies of science. In the category of 'science', most courses fall into the part of 'science as contents', for example: health care communication, energy communication, environmental communication, medicine and society, etc. Less than 20% of the programs have courses regarding the 'hard science' study, except the programs in the Netherlands which require students to participate courses in science/engineering discipline at master level and at Trieste University, Italy, where four areas of scientific studies are addressed: neuroscience, biology, environment, and mathematical physics. For the area of communication studies the focus on media skills and media studies are relatively higher than design courses. In social studies of science most courses are related to science and society. Only five programs have courses on educational studies, with focus on informal learning. Also, some parts of the curriculum fall out of the four areas of study, for example research methodology, research project, thesis, colloquium, workshop, intern, etc.

Figure 2 shows the overview of the relative percentage of the four areas of study, and also the subcategories made from each area of study in this research. The overview of the four areas of study shows that science and educational studies only take up small parts, while the other two constitute most of the curriculum. The subcategories and their relative percentage also indicate the amount of focus given to each of the subjects.

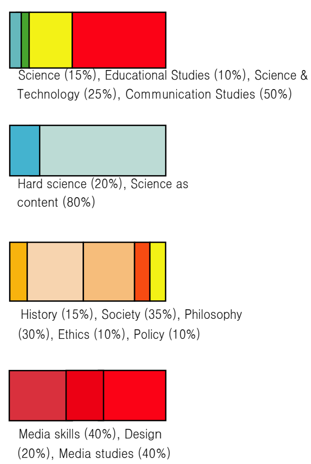

Fig. 2 Relative percentage of the areas of science communication study

Internships and thesis/research projects

Due to the scope and limitation of accessibility to information, in this research only the internships and thesis/ research projects are taken as examples to see how they are structured in length and content.

For the information accessible on internships, 13 out of the 20 programs require students to do internships. The lengths of the internships range from 4-6 weeks to 6 months. The places where the students can conduct their interns also vary. For example, in Canada, University of Laurentienne, students are asked to conduct internships at science-based organizations. In England, Imperial College London and TU Delft in the Netherlands, students have the opportunities to work at science communication organizations. In Italy, Trieste University, editorial offices, press agencies, museums, publishers, companies, research institutions are places where students can conduct their internships. At Dublin City University in Ireland, a work placement during summer or May-September period is offered. The two programs in the United States have more specific internships, at science and health organizations (Florida University), and part-time interns (2 days/week) throughout the academic year at local news organizations (University California, Santa Cruz).

For the programs which require the students to do a thesis/research within the length of the study, they could be done within an organization as a practical, work-based research (as work-placement), or be carried out as a theoretical and research-based project. The percentages also differ from program to program, ranging from zero to approximately one-third of the whole study period.

Objectives, general information and professional profiles

In general the objectives of the programs are very vague and do not state clearly the profiles of science communicators. However, for those who mention unique selling points in the programs, the goals of the programs match more with the profiles. For example, in Brazil, University Campinas, the USP is related to the 'professional profile' of 'scientific and cultural communication'. In Canada, University of Laurentienne, the modules aimed at practical skills is related to the tasks of 'officers at science center' in the profile. At TU Delft in the Netherlands, the curriculum is organized to fit with the professional positions mentioned in the career prospects.

Objectives, profiles and the curriculum

According to the Mulder model the four areas of science communication study relate to the profiles of the professionals based on combinations of different studies. By cross-comparing the objectives, profiles and curriculum in each program, it is clear that most of the curriculum fits into the profiles and objectives. For example, University of West Australia describes the objectives as "cultivation of students for developing the practical skills and design strategies for the communication needs of groups such as government organizations, informal museums, science centers and research centers" and focuses the curriculum on science, communication studies and science & technology studies. Based on the profiles described in Mulder's model the profiles of science communicators are 'PR, science communication advisors, science policy advisors, science journalist, and employees at science center/museum' which matches with the combination of the science communication studies. However, there are still some programs which state in their objectives or career profiles to aim at cultivating some particular science communication professionals but do not include relevant studies in the curriculum. Several programs include profiles of science communicators at science centers but do not organize courses related to the area of 'educational studies' while some programs aim to train students to take into account the social issues regarding science and technology but fail to structure courses in the 'science & technology studies' area.

Conclusions and Recommendations

The paper explores how the science communication curriculum relates to the professionalism of science communicators by investigating twenty science communication university master programs worldwide. To answer the main research question: Do science communication university programs equip students to become professionals?, the relations between the programs objectives, structures and contents of the curriculum, and the profiles of communication professionals were explored. Based on the results it is still doubtful to what extent the science communication programs equip students to become professionals. Most of the program objectives are too vague, with no indications of either the prerequisites or the basic requirements within each area of study. Also, most of the programs do not give clear descriptions on the profiles of science communicators, although most of them organize the curriculum to accommodate different areas of study with combinations of interdisciplinary subjects which matches with the professional profiles in the Mulder model. Due to the vagueness of the program objectives, insufficient descriptions of profiles and the lack of coherent link between the curriculum with the objectives and profiles, for potential students the relation between the curriculum and the professionalism of science communication is not visible at all.

From the conclusions above, we suggest that science communication university master programs should pay more attention to providing clearer information regarding the curriculum for potential students. Several recommendations are proposed:

- The profiles of science communicators could be used as a basic guideline for developing the curriculum by centering program objectives, the structure and content of curriculum to reflect on the real world of science communicators.
- Each program should provide clear objectives and profiles of science communicators, with given examples or references to the activities and organizations of communication professionals.
- Each program should stress its own strengths and uniqueness to market their programs, and emphasize on how the objectives and USPs relate to the profiles.
- The programs should be clear on how the courses in the four areas of study fit into the profiles.
- The part of the curriculum which does not belong to the four areas of study, for example internships and

research projects, should also be addressed and linked to the profiles

- Since it is stated that for professionals a recognizable and valued concentration of knowledge and skill (Priest, 2010) is important, more research is needed on the key activities of science communication professionals to establish the competences in order to provide a clearer overview for the profiles of science communicators.

Discussions

Regarding the quality of the research, there are certain limitations regarding collecting information online, whether the information reflects truthfully on the actual status of the program researched, or whether the information is complete and accessible. A qualitative interview or survey on relevant actors of the programs (coordinator of the program, students or alumni) should be the next step of this research to increase the validity of the results. To grasp fully the status of science communication university master programs worldwide, it is also essential to continue collecting more information on the programs, and include successful examples.

In our opinion, regardless of the large differences of the subjects within each area of science communication study or the lack of coherence of the curriculum worldwide, the existing science communication university master programs are still successful in the regard of providing students with a general overview of what science communication is. As a new discipline where communities coexist (Bell, 2010), we think that the development and organization of the curriculum is a dynamic process and will certainly change in accordance with the growth of the discipline, the development of science communication research, and also the profiles of science communicators. Although there remains much differences and varieties in the organization of science communication curriculum in the existing programs, perhaps at the same time it is also one of the advantages in this discipline, in which its flexibility and dynamic nature can accommodate more opportunities and possibilities in developing the curriculum. Thus, the universities should definitely not rush to conclusions and decisions on a program with a fixed structure. Rather, they should work on drawing up visions and views for the status of science communication, how the discipline fit into the academic level of study within the university and also what resources the universities have to offer and contribute to the program.

It will certainly be challenging to remain the flexibility of designing and developing a science communication curriculum with so many uncertainties. Adaptations should be made to meet a broader and higher level of societal needs and also from different circumstances in different countries, where different communities, possibilities and disciplines coexist.

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116. Arts Based Science Communication Approaches to Create Awareness

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Abstract. Technological advances have revolutionised knowledge generation, but while knowledge is increasing exponentially, access to complex and interconnected datasets becomes a problem not only for specialists. Scientific advances at rising pace leave the general public increasingly doubtful about benefits provided by research, irrespective of the fact that research remains the basis of modern societies. The enormous body of knowledge generated by research appears inaccessible even to specialists and awareness of simple scientific facts is complicated to generate. We have successfully explored arts based approaches in science communication providing emotional access to scientific facts and supporting awareness rather than knowledge generation.

Keywords: Art, awareness, emotional access, knowledge generation

Introduction

Historically people have benefitted greatly from scientific advancement. But while science impacts on every aspect of our life now, there is a growing sense of distrust in the scientific method at least in the developed world. Clearly science and technology are central to knowledge-based societies, but with increasing possibilities the potential of harmful consequences is also rising. As a result, the dissemination of science and technology and broad public engagement have become a focus of publicly funded activities, which can be summarised as science communication (SC).

Science Communication with an agenda

The Universal Declaration of Human Rights states in Article 27: Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits. Also the Lisbon agenda for Europe brings home how deeply inscribed science remains in our contemporary societies. In the perceived societal consensus that science is a central functioning principle of civilization roots a supportive science journalism. In parallel publicly funded SC activities are performed with the purpose to promote acceptance of technology, career choices etc. Thus actors within SC frequently have an agenda and thus lack independence in the view of a critical public.

But SC has to be more than the education of citizens and the provision of information about science, namely the construction of meaning and design of techno-scientific futures. SC should thus be about building a shared understanding which can promote some sort of change, might it be in perspective or action. The solution is to perform SC in forms suitable for communication and dialogue. But communicating science in ways that are useful and meaningful for both science and society remains an unresolved challenge not least because the deficit model underlying the public understanding of science remains very strong amongst scientists, policy makers and the media.

Challenges in Science Communication

According to the deficit model the public was to marvel at science, learn the basics at school and experience technological change in their workplaces, while science and technology and the choices about its future directions remained in the hands of scientific elites1. Many scientists and science managers regard the public as irrational and not able or willing to understand or engage in sound argumentation. Moreover, society becomes a source of regulation and prohibition. From such an attitude, re-contextualisation is seen as something forced on science, rather than as a challenge to do better. Current initiatives at public engagement are already seen as going too far, and autonomy should somehow be restored. In this aspect SC faces several critical challenges 2,3.

While Article 27 reflects on a close link between science and art, in public opinion and the perception of many researchers, science can be separated from society. Linking arts and science thus might bridge this perceived gap.

Communication Models Lack Emotion

Prevailing peer-to-peer scientific communication widely frowns on emotional qualities, favouring objectivity and personal detachment. These professional standards are often imported into communication strategies to non-specialists, despite the fact that scientists frequently relate to their research with high emotional quality. Recent research identifies emotion as one of the key determinants for our memory4. As our sensory input is processed, it is associated with emotional valence and arousal, the two dimensions of emotion. The most vivid memories tend to be of emotional events, which are likely to be recalled more often and with more clarity and detail5,6. While the effect of emotion in advertisement and communication appears to be common place, in learning it has been widely neglected7. Using arts based approaches as an emotional anchor for complex scientific ideas is thus an innovative approach, promising on the basis of recent research.

Art provides emotional access to facts

Knowledge and awareness are clearly distinct, as is apparent from numerous examples where action is avoided despite better knowledge. Only awareness of a fact will result in appropriate action. Art is a powerful means of presenting truths and associating subjective and emotional experiences with facts which supports awareness building. Art also connects people in a society by presenting an idea that everyone can relate to in a universal way. Therefore art has the potential of overcoming some current challenges in SC.

Art in our successful SC activities

Figure 1. Farmer Hans and DiNA the gene-tically engineered hen discuss the pros and cons of transgenic production of medicine

In our view SC is challenged with the problem to provide instructive access to complicated issues, where direct access to the scientific process is limited. Therefore methods are sought, which can provide emotional access to scientific facts. We have argued that successful communication of complex scientific content with lasting impact requires emotional access to create awareness and arts based approaches might be fruitful in this respect. dialog<>gentechnik has used art in different SC activities successfully:

Theatre: In a 20 min play about DNA technology aimed at children of 8-12 years “farmer of the future” Hans tends meticulously to his prized hen DiNA, which was genetically engineered to produce antibodies as medication against cancer in her eggs (Figure 1). DiNA is a chimera, as her chicken DNA contains a small piece of human DNA as well. DiNA is upset and has many critical questions about this human piece of DNA in her chicken cells, which Hans with the help of the audience tries to answer. After the play visitors are offered the opportunity to isolate DNA from vegetables and/or draw chimerical animals. They are asked to give their drawings a name and

Figure 2. Two 11-year old visitors prompted after the play to draw a chimeric animal supplied the following description to their drawings: (top) Name-Helper, Special Features-lives in the desert, plants seeds and produces medicine; (bottom) N-Croco-Chicken, SF-explosive eggs

specify their specific features. While many drawings are inspired by popular culture (Harry Potter etc) a surprising number reflect on transgenic approaches (Figure 2). However, while there is no visible change in the genetically engineered DiNA, most children, when drawing their animals do combine different body parts, which are usually associated with the special features. We therefore conclude that young children can reflect on the principle of genetic engineering. The principle of transferring traits between species with a specific purpose appears to inspire the imagination at least of some children. Even in the absence of a deeper understanding of gene technology therefore this play can create awareness of the power of modern methods of gene technology.

Figure 3. Paint your PhD was performed on a scaffold 10 m high with 15 scientists painting for one hour their research topic life in front of an audience.

Painting: The public perception of scientists is dominated by stereotypes, which are recognised to be hard to change and also decrease the likelihood of youth to choose science as a subject. The majority of respondents to a survey in the US are aware that they are under informed about science and scientists, moreover the media is considered to do only a fair or poor job at portraying science8. Direct access to real life science, like scientific work places, can make the public more aware of the true nature of science and scientists, thus contributing to changing stereotypes9. However, as this access is limited we have chosen an arts based approach highlighting the similarities between scientists and artists.

Few people are aware of the fact that science is part of our culture, and the work of scientists is usually only acknowledged within their peer-group. Relating scientists with a cultural profession like painters, in particular in Vienna, which prides itself on its cultural status would associate scientists with more positive stereotypes. We created an activity to provide scientists with a "stage" for their work, make it interesting for the public and raise the awareness that science is an inherent part of our society and culture. During the European Researcher's Night 2009 in Vienna we performed the activity "Paint your PhD". A scaffold was erected for 15 paintings to be produced live during the event by 5 PhD students, 5 post-doctoral researchers, 5 team leaders (Figure 3). They were asked to give a title and a brief description of their research topic, which was provided on site to more than 500 spectators. The one hour of painting was accompanied by improvised life music and a Jury judged all paintings in the 3 categories. The winners received an award and three paintings were auctioned on site for a charity, while the remaining where auctioned via ebay raising more than 3.000 €. The initiator of Paint your PhD Chritoph Campregher was himself surprised by the success of his concept: "Sciences and arts are known to be linked. But with Paint your PhD it became very clear, that scientists can also be artists. Even the jury, both renowned artists, were impressed by the artistic potential scientists showed."

Figure 4. Ivana Primorac– " Regulation of substrate recognition by the Anaphase Promoting Complex/Cyclosome" , one of fifteen paintings ***created during the "Paint your PhD" activity in 2009 awarded 1st prize by the Jury and auctioned for 1000 € on the night for charity.***

According to audience reactions and evaluation questionnaires of the entire event this activity conveyed vividly the high personal identification and creative approach to science researchers take. One spectator wrote: “It was a remarkable experience in the extraordinary surroundings of the Rinderhallen to see by what a different choice of means those fifteen researchers condensed the complex topic of their PhD thesis in one painting. They had, however, one thing in common: it was obvious what an intense time those three, four years must have been ...“

The high identification of scientists with their subject of study became apparent through the intensity of their painting. Several scientists had apparently prepared sketches (Figure 5) and one scientist was continuously coached by his wife. The high level of dedication of scientists, which is contributes to negative “mad scientist” stereotypes, in this activity was reinterpreted as a positive characteristic. Even on the video available the intensity of the activity is detectable, the hard work and time investment of the scientists referring to their positive motivation and work ethic. Therefore by showing how scientists paint their research topic, the audience was made aware of the fact how scientists approach their research.

Figure 5. Ivana Primorac holds a sketch for her painting, which apparently she had prepared for the event.

Music: Music is frequently used to lower barriers and make content accessible. Even people of low education listen to complex music with enjoyment during a movie and there is no specific prior knowledge required to experience music emotionally. Music is also highly versatile, it is part of popular culture and can be combined with other art forms, most notably dance. Music also serve as mood cloud providing emotional cues to subconscious listeners. There have been numerous attempts to translate genetic sequences into music10, since D. Hofstadter first mentions the similarities between genes and music11.

The composer Sascha Selke was commissioned to develop a tonal system for proteinogenic amino acids based on their chemical properties. A preliminary assignment is shown in Figure 6. This allows compositions about biological phenomena like evolution by translating involved protein sequences into appropriate musical themes. These themes are then used in a composition to reflect biological phenomena and will provide a general music interested audience with access to biology.
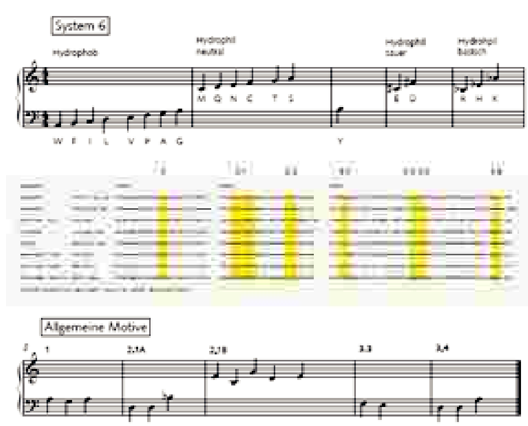
Figure 6. A sketch of the tonal system where each proteinogenic amino acid is based on their chemical properties associated with a note (top). Conserved sequence motifs of a gene (sir-2; middle) can therefore be translated into musical themes (bottom).

In contrast to other gene to music approaches this Selke aims at yielding accessible musical pieces, which are enjoyable to listen to. He uses genetically determined themes and strings them together with conventional musical tools, which allow him to play to the listening habits of a potential audience. This approach is therefore expected to yield music which provides instructive access to complicated scientific topics like evolution or the cell cycle.

The first musical piece has not been performed life so far and therefore no experience with this approach is available.

Visual Arts: Despite the advent of modern technology biology relies heavily on observation and visual data. More than 80 % of data reported and published in biology are images and modern technologies are used to generate these visual data. Scientific images are therefore the most important source of information in biology. Beyond their information content many images have an aesthetic quality and competitions (ie Nikon small world competition) regularly yield stunning images.

Figure 7. J. Lauth and P. Koger produce a dynamic and highly vivid combination of scientific images.

Vienna boasts a lively scene of visual artists, who have grown from modern party culture into an independent art form recently. Their dynamic treatment of digital and visual data combined with a highly technical approach lends itself to a co-operation between scientists and artists. Jan Lauth and Peter Koger were commissioned to produce a visualisation based on scientific images which were produced for a scientific images competition for the European Researcher's Night in Vienna (www.forschenistkunst.at). Based on first-hand experience how microscopes work and scientific data is collected and generated they will project dynamic visuals into the large dome of the Vienna Planetarium with commentary by the well-known Austrian scientist Renée Schroeder in November 24, 2010. A documentation and reactions from the audience will be reported.

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117. Turning Digital Divide into Digital Opportunity-A Critical Analysis

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Introduction

India is the second most populous nation in the Asian region behind China. The country has achieved impressive progress in the field of science and technology and is emerging as one of the strongest economies in the developing world. Information and communication technologies have brought significant changes in development of the Indian society.

The digital divide is defined as the gap between those individuals and communities that have, and do not have, access to the information technologies that are transforming our lives.

Information technology is transforming various aspects of our life all around the world. No other technology is as profound as information technology (IT) in human history has had a great influence on the economy and lives of people around the globe. In India the benefits of IT are beginning to be seen and the impact of these benefits are creating great change. But a large section of population, mostly in developing and under-developed world, is not getting the benefits. This segment is characterized as people on the other side of the digital divide. It is not literacy, but IT-literacy that divides society into digital haves and have-nots. The unequal access to information and communication technologies has led to a massive divide digitally.

The paper discusses initiatives made in India towards digital access to information and the role of several programs in bridging the digital divide.

Today in India, except a few elite Indian Institutes of Technology and some other public and private engineering and management universities, most higher-education facilities do not have functioning computers, except for maybe a few in their libraries. While college officials have computers in their offices, many don't know how to use them; they have their assistants check and print out emails for them. Although most students are computer savvy thanks to numerous internet kiosks in big cities, and even in small towns, many colleges don't use computers and technology as teaching or research aids.

Although India has been one of the emerging super powers in IT, the benefits have been remarkably slow, particularly in rural and remote areas. Besides socio–economic factors, geographic, educational and attitudinal factors have been some of the challenges for the government when introducing IT–oriented programs.

The World Wide Web or the Internet has conked out all boundaries and has tried to integrate itself into one large depository of information, and a system for universal message exchange. Accessibility to Internet, with an email address has become the minimum basic certificate for an IT-literate. Having an email address helps one to get universally connected to all IT-literates, but it is the accessibility to Internet (and the benefits that come along with it) that converts the IT-literate group into the community of digital haves.

The paper highlights the hurdles and barriers to digitization and the need for strong determination, good policy–making and political support in bridging the digital divide in the country.

Scope of the Paper

The scope of this paper is to critically evaluate the efforts made in India in bridging the so called digital-divide. The scope of this paper is to highlight the reflections rather than to sharply draw any conclusions.

The fast developments that have taken place due to technological changes have also propelled a great divide of the information haves and have–nots in the country. The unequal access to information has posed challenges to the government to take appropriate steps to bridge the gap. Some of the efforts made by the government and the non–governmental organizations to bridge the digital divide in the country.

The discussion is based on information collected from various reports, documentary sources, facts and figures and e–resources available to asses the efforts made towards bridging the gap between the "haves" and "have–nots" in remote and rural areas. The discussion is based considering the parameters:

(a) The growth and development of the information society.
(b) The Initiatives, opportunities and prospects made towards bridging the digital divide.
(c) Barriers to bridging the digital divide.

Growth and Development of the Information Society

Information and communication technology has given rise to many benefits in our society. Tools like television, radio and the much talked about Internet have always given direction to change. The application of IT in various fields and Internet technology has been able to influence larger sections of society since its development.

Technological change is the major contributor to the growth and development of the information society; e–learning, e–libraries, e–health, e–governance, etc. have become pillars of the information society. Raising these concerns, a world summit was organised by the United Nations in 2003 in Geneva, under its General Secretary, Kofi Annan. The goal of the summit was to develop a common vision and understanding of the information society and to draw up a strategic plan of action for concerted development towards realizing this vision. Access to information in society is not uniform and globally there has always been a gap between those people and communities who can make effective use of IT and those who cannot, leading to a kind of digital divide.

The government of India has declared IT as one of the thrust areas for the country's development and has recognized it as an "essential service. In India the use of IT and computers began way back in 1978. In 1985 the government decided to increase the pace of information technology at the district level.

The National Information Centre (NIC), a central government organization, that was chosen to implement a national programme called "DISNIC," Information System of NIC, to computerise all district offices. Commissioning nearly 500 computer centres to a country–wide network, and connecting these computers, was a major breakthrough in this field that led to remarkable social changes. Earlier, people were reluctant to this change thinking that it would take away people's jobs. But today a remarkable change in mindset is apparent. Many state governments like Andhra Pradesh in Hyderabad, Maharashtra in Pune, Delhi and Noida have Cyber Parks, Karnataka in Bangalore, etc. have developed cyber–cities.

Challenges and Barriers to Bridging the Digital Divide

Although the country has increased its literacy rate to an encouraging 65.38 percent according to the 2001 census, much more efforts are required. The government has made steps to improve the lives of common people through several projects. But we need to look closely at Indian society.

The nature of Indian Society

India is a developing nation which is geographically vast and varied. India is a multicultural, multi–language and multi–religion country with complex socio–economic conditions. The growing population, insufficient funds, and delays in implementation of government policies and programs have been some of the challenges that have lead to unequal development in the society.

Due to these characteristics it has its own compelling challenges. For a country with such large population and scarce resources, computer technology comes as a great tool of social transformation. It has already revolutionalised the field of communication and in convergence with mobile and internet technology is changing the way Indians communicate.

Facilities like supercomputers are quite at disposal of few urban elite intellectuals like scientists, engineers and policy makers and makes indirect impact on the population in general. While some people are rich and have many resources, others do not.

Few years ago, a low-cost handheld dubbed the Simputer was touted as a way to give villagers in poorer countries access to computing power. That dream remains elusive. Very few Indian villagers have even seen one, and the government agencies and nonprofits that were target buyers have barely bitten.

The educational system of India also has been slow to achieve the set target framed by various commissions and committees and schemes launched from time to time.

Indian society in general has slowly awakened to this computer revolution and technological advances are also being made taking into consideration the requirement of different segments of the Indian society.

A fundamental requirement for reducing the digital divide in countries is to give priority to the development of their communication infrastructure and provide universal and affordable access to information to individuals in all geographical areas of the country. There are a number of barriers to bridging the digital divide. Although underserved communities in India are gaining access to computers and the Internet their benefits are limited because of the following factors.

Infrastructural barriers

Despite the incredible growth of the Internet since the early 1990's, India still lacks a robust telecommunication infrastructure with sufficient reliable bandwidth for Internet connection. Due to high costs the necessary upgrading of hardware and software is cumbersome; hence, despite the rapid spread of the Internet the gap is growing wider as the technological standard grows even higher. Faster networks, higher level machines, more complex software and more capable professionals are required, but in many nations including India the funding is not available to support these developments.

Libraries and information centres , with their commitment to freedom of access to information and promotion of life–long learning in India, are yet to have a robust infrastructure.

Literacy and skill barriers

Education and information literacy will play an important role in keeping society from fragmenting into information haves and have–nots. In the perspective of the digital divide, IT literacy is very important to allow access to digital information. In a country like India where roughly 50 percent of people do not have reading and writing skills for functioning in everyday life, IT literacy is out of the question. Generally, online content and information have been designed for an audience that reads at an average or advanced literacy level and those who have discretionary money to spend.

Education in information literacy will play an important role in keeping the society from fragmenting into a population of information haves and have–nots. The lack of skill in using computer and communication technology also prevents people from accessing digital information.

Economic barriers

Poor access to computer and communication technology also causes a digital divide. In India the ability to purchase or rent the tool for access to digital information is very less among the masses.

Public libraries which can provide access to the Internet do not have computers and Internet access. Although cyber–cafes have been increasing at evry nick and corner, poor people cannot afford to have access due to high costs.

The lower income group does not have money at their discretion to spend on cyber–cafes or to get Internet connectivity on their own to access digital information.

Content barriers

The Internet allows ideas and information to be shared freely from citizen to citizen globally. In many ways the strength of the Internet is a function of the number of people and organizations creating quality content. Since no entity controls the Internet, anyone with Internet access has the potential to contribute information. Therefore, to solve the digital divide, steps should be taken by the government to ensure that all citizens are able to receive diverse content relevant to their lives as well as to produce their own content for their communities and for the Internet at large.

Language barriers

India is a country having a multicultural and multilingual population. India is divided into states on the basis of language. Even though the Indian government works officially in English and Hindi, the language of administration differs from state to state. The Eighth Schedule to the Indian Constitution contains a list of 22 scheduled languages.

Due to British rule, English is understood in all the states and is therefore works as a common thread of communication between all the states. Hence when computer was introduced in India, English became the language of communication with computer as well. But general public's inability to understand English became the biggest block in reaching out to masses.

When we look at the statistics of Internet pages, 84% are in Latin based scripts (i.e., English, French and other European languages), 13% in CJK scripts (Chinese, Japanese, and Korean based scripts), and all other languages of the world combine to make up for the remaining 3%.

There is no precise statistics available for Internet pages in Indian languages, and it is estimated to be at most around 0.3%! India is a multilingual country having 18 recognized languages written in 12 different scripts including Arabic and Latin (English).

The remaining ten scripts are Devnagari, Bangala, Gurumukhi, Gujarati, Oriya, Tamil, Telugu, Kannada, Manipuri and Malayalam. These have evolved from the ancient Brahmi script and they are together referred as Indic scripts. If we include the People of Indian Origin (PIOs) staying in other countries, it is estimated that around 22% of the world population speak languages that are written in Indic scripts. Then why there is only 0.3% Internet pages in Indian languages?

Unicode

The Indian Government had realised in 1980s itself the need to make computer accessible in all Indian languages. It focused on two key issues: script encoding (the way an Indian script should be stored in computer memory or disks) and keyboard standard for all Indian scripts. For script encoding, it proposed ISCII standard (for 8 bit encoding), and in 1998, UNICODE standard (for 16 bit encoding). Unicode is becoming far more attractive as this scheme treats all scripts of the world uniformly, and the most of the Internet browsers (since the year 2000 like Internet Explorer, Mozilla, etc.) are giving an in-built facility to view any Unicode encoded Internet page written in any script, or any mixture of scripts. Furthermore, the most famous and powerful search engines like Google has started accepting search words and phrases in Indian scripts, and its search coverage encompasses all those sites whose pages are encoded in Unicode.

Yet, there does not seem any accelerated growth in Internet pages written in Indian languages?

To develop a site in Indian languages you need mechanisms to input Indic scripts. The Department of IT (formerly the Department of Electronics), the Government of India, standardized INSCRIPT keyboard layout for all the ten Indic language scripts as early as 1991. INSCRIPT keyboard standard is a bilingual keyboard, i.e., English with one of the Indic scripts. In contrast, most of the countries in the world are monolingual, and hence a keyboard with a single script is sufficient for their use.

At present, to input any Indic script, we have two mechanisms: (a) use a bilingual keyboard, or (b) display the "Indic keyboard layout on monitor," and choose different letters through the mouse. The latter scheme is usually not used in those applications where user interactivity is very high (e.g., word processing). The bilingual keyboard comes in two styles: (a) Key tops are engraved with Latin script and one Indian script, or (b) the key tops of standard Latin keyboard are pasted with a paper/plastic film which has Latin and one Indic script printed over it. Usually, it is the latter case of usage, as the market of bilingual keyboard has not picked up yet. This latter scheme has a strong limitation, as after sometime either the paper/plastic films on the key tops get torn, or get dirty. This makes the keyboard illegible and unusable. Further, the people who are not familiar with English do not feel at home with either of these two solutions. And this is the main cause of digital divide!

Further, this bilingual keyboard does not permit to mix two or more Indic scripts, e.g., Hindi & Bangala, or Hindi, Tamil and Kannada, etc.

We feel that there should be only one keyboard (call it Brahmi) that can be used for any of the twelve Indian scripts (including Latin and Arabic) simultaneously. The Brahmi keyboard will have key tops with LCD display, and the letters are displayed, not engraved. In addition, there should be a "script selection knob" to switch the keyboard from one script to another at any time, irrespective of its state. With Brahmi keyboard, a user can type any mix of the 12 Indian scripts in his text, and this single keyboard can be used throughout India!

To develop Brahmi keyboard none of the research institutes or CSIR labs would be interested, as there is no research content in it. Neither a venture fund will be interested in putting money as the estimated cost of Brahmi keyboard would be far higher than Rs. 300, the present cost of an English keyboard. The result is the perpetuation of digital divide! But is there any way to get out of this trap?

CDAC developed a GIST technology which has to its credit several innovative products and cutting edge technology which have revolutionized computing and made GIST synonymous with Indian Language Computing. Its areas of Research are impressive and cover the full gamut of computing: Natural Language Processing tools (such as spell and grammar checkers, natural query), Search plug-in's, Semantic Web, Video Technologies, fonts technology, expert writing systems, image processing (Optical Character and Handwritten character Recognition), Speech Processing, Embedded and Mobile Computing to name only a few.

Today GIST technologies forms an integral part of mission critical activities of various organizations. Mindful of the social function of computing the GIST technologies also powers the National initiatives especially meant for masses in the areas of e-Governance, education, agriculture, health, banking and communication and so on.

Google's transliteration effort

The latest to contribute to the development of software offering uniform platform to Indian languages is the software giant Google. Transliteration is the method to enable users to enter text in one of the supported languages using a roman keyboard. Users can type a word the way it sounds using Latin characters and transliteration script will convert the word to its native script. Till recently this service was offered online only–means you need an internet connection for transliteration. Now Google has launched the new transliteration software–"Google Transliteration IME" which enables offline transliteration also.

This is available today for 14 different Indian languages–Arabic, Bengali, Farsi (Persian), Greek, Gujarati, Hindi, Kannada, Malayalam, Marathi, Nepali, Punjabi, Tamil, Telugu and Urdu.

Conclusion

The unequal access to information and communication technologies has led to the digital divide not only in developing countries but globally as well. It goes against the well known adage-that the world is a global village as proposed by Marshall Mc Luhan. Although India has made encouraging efforts to bridge the gap by initiating a number of projects and programs for rural and remote areas, much more needs to be done to bring the people into the information society and make them active participants in the process of development. All that is required is strong determination among people, good policy–makers and political support to bridge the digital divide.

Libraries and information centres play an important role in providing information to all in order to reduce the gap between those who have the facilities to access digital information and those who do not.

Although peer-reviewed journals have been available on the Internet for many years, the digital divide has continued to pose as a challenge for the developing world. The digital divide is keeping out the developing world from very useful research information. This Bridging would give researchers free access to high quality research articles. This drastically improves the quality of research input in developing nations.The country needs to improve the infrastructure of public libraries and link them with community information centres. International support can help developing countries to benefit from technological advancements and enhance their productive capacity.

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118. School and Children as a Media to Educate the Public about Science

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Abstract. Communication is indispensable to science. Knowledge that is not communicated is worthless. It is also crucial however, that the communicated knowledge is correct. The communication of knowledge plays an increasingly vital role in a global knowledge society facing challenges in areas such as the climate, nutrition, ageing societies, maintaining biodiversity and others. Scientific literacy is increasingly important to function in society. School media (especially children) are the primary source of communicators on science and technologies. Developing effective science and technology based educational programs is more complex than it appears at first blush. This paper tries to explain how school and public science can form a fruitful interaction. The purposes of the study reported here was to document and evaluate the role and effectiveness of our Science eco-club and assess our organizational framework. Science and eco-clubs are a unique opportunity to educate children about science environmental issues. objectives include: (1) educate children about their immediate environment by increasing awareness; (2) impart knowledge about eco-systems ,science and technology their interdependence and need for survival, through visits and demonstrations;

(3) mobilize children by instilling a spirit of scientific inquiry into environmental and scientific problems; and (4) involve children in active science and technology, environmental preservation efforts. We have introduced Uniform and Band along with a structured programme of formation of disciplined five teams of student cadet for water, plants, energy, waste management, land use planning, and these disciplined teams are involved in school level or community level physical environmental actions.s exclusively in our School Science eco-club. Our Cadets are the Green Brigade of the school, protecting the natural resources from misuse and promoting the conservation of the natural resources. Final Findings show that the science eco-club provides: Self confidence, new life skills, Model for peer groups, Social responsibility. Remember, our travel should not become travail for others. Let us give it a thought; let us become more considerate towards fellow beings; let us change our attitude and bring in a change. Nature as an arena for the quality of life is a topic of utmost concern, for it will impact on future generations.

Keywords: Mock eco assembly, NGC camps, NGC environmental discipline, Science eco-clubs

Introduction

Science eco-clubs are internationally recognized as a powerful tool to change the community through the activities of children. India's National Green Corps (NGC) Science eco-clubs are a unique opportunity to educate children about environmental issues. Objectives include: (1) educate children about their immediate environment by increasing awareness; (2) impart knowledge about eco-systems, their interdependence and need for survival, through visits and demonstrations; (3) mobilize children by instilling a spirit of scientific inquiry into environmental problems; and (4) involve children in active environmental preservation efforts. The aim of the Science eco-club is to develop a green consciousness social responsibility: and through Our Science eco-club we are trying to groom the Cadets as an environmentally disciplined force. We have introduced Uniform and Band along with a structured programme of formation of five disciplined teams of cadets water, plants, energy, waste management, land use planning, exclusively in our School Science eco-club and these disciplined teams are involved in school level or community level physical environmental actions. Science eco-club activities constitute: (1). Spreading the Word and (2) Launching an Action, as follows. (A) Eco Walks (B) Eco Rallies (C) Eco Demonstration (D) Eco Placards Display and Eco Banners (E) Environmental Road Shows (F) Environmental Speeches (G) Environmental Seminars (H) Environmental Activities and Campaigns (I) Students Environmental Projects (J) Mock Eco Assembly/Parliament and (K) Environment Exhibitions. As part of the science eco-club Activities School environmental Audit Program performed at our school in November and December 2009.Nature as an arena for the quality of life is a topic of utmost concern, for it will impact on future generations. Our Cadets are the Green Brigade of the school, protecting the natural resources from misuse and promoting the conservation of the natural resources. Our science eco-club is expected that there will be huge difference made to the way the resources are consumed and conserved.

Program Design

We live in a globalize world. Acknowledge of this, means accepting that we must adapt and prepare ourselves as best we can; so we need to redefine and make changes to meet the new demands of the 21st Century. In education, this has generated a radical turn within classroom and school pedagogical processes. The core knowledge and competencies that support self learning and life-long learning have now a fundamental role in the student's learning process. Many new educational proposals suggest the need of rethinking education, so that students grow up to be good citizens, capable of living together in a democratic, inclusive and pluricultural society within a complex and changing social environment. A competency based education teaches students to develop the knowledge, skills and attitudes that allow them to solve daily problems; to keep learning through out life; to be an ethically responsible person; and to respect and be able to work with others, as demanded by globalize world. It is a means of aiding in the personal development of students that will eventually prepare them for the challenges society and work sets before them.

While some states in the country are still grappling with the implementation of the NGC program, Andhra Pradesh has become the first state in the country to upscale the National Green Corps to cover all the schools in the state through the establishment of the Directorate of National Green Corps. This is a tremendous step towards developing a cadre of environmentally aware citizens.

It has also been the first and only state in the country to implement the Supreme Court's decision on environment education in formal curricula by preparing special textbooks for standards 1 to 10. This is unprecedented in the country.

The NGC program has been appropriately designed to ensure effective implementation. The NGC team has developed a close collaboration with key individuals in the Education Department even on a personal level ensuring adequate support for the program.

NGC Environmental Discipline

Today Environmental Movement in our country lacks focus on "Environmental Discipline". The need of the hour is to create Environmental Discipline in the younger generation. Earlier NGC Students Environment Movement was based on Environmental action. This was a step ahead from environmental awareness. Now since there is a need to move forward in order to protect our environment and ourselves, NGC took a stand to instill Environmental Discipline in 8th class students through 5 NGC Eco club teams in each NGC School. The first step is to promote disciplined movement and action promoting environmental discipline. This is a clear shift of NGC from environmental knowledge promotion to environmental discipline promotion.

National Green Corps programme aims at spreading 'environmental discipline' among school children and involves them in environment related actions in the schools and communities. Children have infectious enthusiasm. They are custodians of natural resources and nature.

We all know that we are part of the environment we live in, and the solution to many environmental problems lie in our attitude towards environment-be it awareness to keep our surroundings clean or the realization to conserve natural resources by re-using and recycling wherever possible. On the surface it looks simple. But changing the attitudes of people is not going to happen overnight.

The best way is to initiate community into action through children. They have no vested interests. They are impressionable. They are our future. They are the single most important influence in any family.

Activities

1. Building 5 NGC natural resource management teams in each school and conducting NGC weekly parade drill for 20 weeks along with band.
2. Conducting Daily Natural Resource Monitoring through 5 NGC students' teams and Annual School Environmental Audit by November every year.
3. Participating in District level parade on 15th August Independence Day and 26th January Republic Day.
4. NGC Eco Club Student Cadets will be in charge of retaining cleanliness in the mid day meals or daily lunch time and also greening the school premises. In the above context NGC trains PET/PD of the selected/registered schools. The NGC training program covers parade drill and natural resource conservation monitoring and environment audit.

Objectives

- To create environmental discipline among school children.
- To train young students for environment action.
- To utilize the unique position of school children for awareness of the society at large.
- To facilitate children's participation in decision making in areas related to environment & development.
- To bring children into direct contact with the local environmental challenges and respond positively.
- To involve children in disciplined action based programmes related to environment in their neighborhood.

NGC Parade Foot Drill

The aim of the drill is to inculcate discipline, improve smartness in appearance, turnout, and self confidence and to develop qualities of team spirit and obedience in the cadets

NGC Camps

Let's learn and enjoy. AP NGC is promoting 'environmental discipline' amongst students through NGC Eco Clubs. Promoting environmental discipline and action are on the agenda for conducting camps at various towns in Andhra Pradesh

Each NGC Camp will cover the following aspects:

1. Drill practice
2. Band practice
3. Natural resource use monitoring and auditing.
4. Visit to locations environment improvement activities

National Science Day on 28th February

It is envisaged that thirst for knowledge and desire to innovate can exist among students at varying degrees of preparedness, from urban to rural regions. To enhance the awareness, interest and opportunities at all levels for innovative thinking, multi-level competitions on regular basis can be of great help. To enhance the need of developing such an attitudes our Science eco-club organized school level celebrations of national science day on 28th February, 2010 in that we conducted essay writing competitions as follows: "Disaster Management Importance of Science" elocution competitions: "Planet Earth-Natural Resources-Sustainability".

Earth day April 22:

Earth day is an annual observance held on April 22 every year to increase public awareness on the environment. Earth day activities offer important point of entry to address world wide environmental concerns as well as opportunities for individual and community to focus on their local environmental problems. Earth day should be used as a powerful catalyst to involve people in making a difference towards a healthy, prosperous and sustainable future. Keeping in mind the importance of Earth Day, the Science Eco-Club celebrated the Earth day–2010 with the active involvement of School Community, on the auspicious occasion of the Earth Day: Cycle Rally cum public awareness programme was conducted.

Week Programme in Our School

We have conduct week long environmental programme in the schools by forming into teams for water, waste management, energy, biodiversity and land use planning by taking an oath to protect environment. On the first day we prepare a school map incorporating the resource we are responsible for including the drinking and waste water routes, waste pockets and location of trees. On the second day our focus is on water tank cleaning and monitoring and tree plantation and plant protection. On the third day, we focus is on planning & making arrangements for rain water diversion & harvesting and Playground, Parking planning, school cleaning, dust bin introduction. On the fourth day, we conducted Quiz, Essay writing and Elocution competitions along with Eco Cultural programmes. On the fifth day we the focused on planning composting of waste and linkage with the local waste handlers and conducting the Mock Eco Assembly and the final day activity is to plan Science eco-club management, Eco calendar and reporting the progress through the School Wall Magazine.

Mock Eco Assembly

Grooming in Leadership and Environment Awareness: Our Eco-club organized A ‘Mock ECO Assembly’ At our School the Participants Came in Batches, Posing as Legislative Assembly Members from the Ruling and Opposition Parties, Sat at the right and left sides respectively and exchanged views and concerns about environment issues facing the Country. We feel that, we are the future youth leaders presenting our views on the steps to be taken for the welfare of the country and how to work towards achieving India, a dream nation and stand high in the World. As The Mock Eco Assembly Was Aimed At Instilling Confidence, Improving Communication Skills And Environment Awareness In Children at the same time the eco assembly programme are to strengthen the roots of democracy, to inculcate in the young minds healthy habits of discipline, tolerance of views of others and to equip them with the knowledge of assembly procedures and eco friendly practices.

Eco School Audit Process and Green Schools Programme Report

The Eco school audit process assists students in conducting audits and develops action plans on air, energy, land, waste management and water management in the school environment.We are done all the chapters simultaneously, as five teams are working on the five different resources. Five teams comprising of children from class VIII & IX coordinated by the teachers, one each for the five, segments are responsible. There are 5 to12 children of mixed classes in each group. All the teacher coordinators have found that children are enjoying auditing their particular resource.

Major Findings and Suggestions of Eco School Audit

Water: Sanitation facilities and Rain water harvesting methods have to be improved with the help local public representatives.

Air: Oxygen balance has to be improved by planting and protecting of trees.

Land: Green area has to be improved by planting the trees in the forth coming rainy season and Special policy document has to be followed on land use and biodiversity.

Energy: Renewable energy resources have to be adopted in Mid Day meals Cooking and Using CFL bulbs have to be encouraged.

Waste: Collection of used text boos at the end of Annual Exams by the school and to maintain Book Bank and Some manure pits and land fills have to be dogged in the school.

Environmental Camp:

The National Green Core (NGC) and Tirumala Tirupathi Devasthanams jointly organised `eco camp’ has really empowered and ignited the young minds during their 10-day stay at the most popular pilgrim centre of the country. A total of 49 students representing different schools got an opportunity to spend their time learning and enjoying at the TTD from May 22 to 31 as part of their `NGC-TTD Eco camp’. We were exposed to different activities right from serving the pilgrims at the huge kitchens where free Annadanam is offered to the pilgrims coming from different parts of the country. We visited sewage and solid waste management plants, water filtration beds, nursery management, solar cooking, wind mills learning the alternate sources of energy and energy conservation methods in practice. We only studied in text books about the wind mills, but they got to see practically during their visit to the temple at Tirumala. “It is quite unimaginable,” and with this visit. “We learned a lot about water filtration process and solid waste management. We made lot of discoveries that really surprised us,” The students – members of the Eco Clubs functioning at various schools across the district were picked up by the NGC only to expose them to the environmental protection methods and putting to use the non-conventional energy sources. From this we were also made to inculcate a sense of service by drafting them to duties serving the pilgrims at various points. The main objective of the camp was to make every student a responsible citizen and activate the Eco clubs formed at various schools.

Conclusions

Science eco-clubs make a difference. Science eco-club schools are showcases that influence other schools and local communities and by sharing their experiences they transfer environmentally friendly technology to the communities through a community based environmental movement. There are solutions to the major problems of our time; some of them even simple. But they require a radical shift in our perceptions, our thinking, and our values.”
(Fritjof Capra, 1996).

Final Findings shows that the science eco-club provides: Self confidence, new life skills, Model for peer groups, Social responsibility.

"Earth has enough for everyone's need but not enough for even one's greed"

Mahatma Gandhi

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119. Mentoring Network Model and Evaluation Scheme

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Abstract. Little is known about the evaluation scheme of measuring how successful a mentoring is. There are no tools of success factors for formal mentoring program. In this presentation we introduce the Mentoring Network Model (MNM) based on a formal mentoring program at the WISE (Women into Science & Engineering) Main Center at Ewha Womans University.

The Mentoring Network Model (MNM) is a visualizing model to represent the human networks among mentors and protégés by using a network diagram. The model contains not only people participated in the mentoring but also all members' relations such as friendship, alumnae, colleagues in the same organization, and neighbor.

By assigning three factors- node, relation and field to the MNM, we analyze the MNM. The nodes represent members and relations between two nodes are expressed by a line and the field is the physical or virtual area representing nodes and the relation in a 2-demension rectangle. If some mentors are belonged to same department of an organization, they can be assigned in same field.

We introduce three indexes- affinity, time and grid-complexity related to the relation of MNM. Affinity (A) is an index for affinity between two members. The affinity is based on the age gap, locality, and personality. We assume the closer network, the better condition for mentoring. The second index, time (T) represents the quantity or time of mentoring activities. We assume the more frequent on-line and off-line interactions between two persons make the index T bigger. The last index, grid-complexity (G), is a complexity index that shows how many relations per node exist in a model. By defining three factors and indices to MNM, we introduce an evaluation scheme how successful the mentoring is. We apply this MNM to WISE mentoring fellow program.

Keywords: Mentoring model, Mentoring network model

120. The Interactive Platform of Science Communication in Science Center

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Abstract. Science Center (Science and Technology Museum) is a new science communication institution, it plays a special role of carrier in improve the public's scientific literacy. Mass media, such as television, newspapers, computers and Internet, is still an important way for the information dissemination and exchange. How to employ the mass media to build up the interactive platform of the public and Science Center in science communication is a challenge. This paper analyze the characteristics of mass media and science communication, research how to build the interactive platform to promote the science communication and take the science activities in Guangdong Science Center for example.

121. Values and Evaluation: Leximancer as a Tool for Analysing Values in Science Communication Transcripts

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Abstract. Best practice science communication research, practice, and evaluation often dictates the use of focus groups and interviews, and yet techniques for analysing data from such collection methods are rarely discussed. This paper reports on the use of Leximancer, an automated text-mining software tool, to examine and compare transcripts from two focus groups. Participants included in this study were part of an upstream engagement process aimed at getting leading Australian farmers together to form a cooperative group to disseminate scientific information about managing climate variability and climate change. Findings from the study show that while cursory automated qualitative analysis of transcripts may not serve as a substitute for in-depth analysis, they may be complementary.

Keywords: Science communication, Values, Focus groups, Engagement, Transcript analysis, Leximancer

Introduction

Qualitative research methods such as focus groups and interviews are commonly employed mechanisms for assessing attitudes and perceptions of participants in science communication engagement activities. They are also frequently recommended as evaluation tools for such activities (1-2). However, while many of these guides describe how to carry out focus groups and interviews, there is little direction offered on what to do with the data once they are collected.

In this study, I conduct an exploratory qualitative investigation of two different focus group conversations using an automated textual analysis tool known as Leximancer. Leximancer is a highly customisable text mining software tool that uses word frequency and co-occurrence to identify families of terms (3). In essence, Leximancer uses lexical relationships and a thesaurus to develop “concepts” and then “themes” from documents (4). It has been used in both academia and industry to examine a variety of texts including interview transcripts, websites, surveys and emails, in fields such as History, Literature, Media Studies, Sociology, Politics, Psychology, Management, Business, Tourism and general Communication; however, its use and profile in science communication has been limited to date.

The observations made in this paper are not intended as a best practice guide, but offer some insight into how Leximancer may (or may not) be useful for analysing focus group transcripts.

This study is part of a larger project examining participant, organiser and facilitator values in emergent engagement. The study’s specific aim is to determine the usefulness of Leximancer as a tool for identifying values that emerge from value-oriented talk in upstream science communication. However, this specific aim does not distract from the goal of this paper in assessing its usefulness for science communication focus groups more generally, since I am simply considering Leximancer’s “themes”, which are made up of “concepts”, as potential values. While at the early stages of this project, where emergent values are not defined as yet, I also make some preliminary observations about the use of Leximancer to elicit “values” in transcribed conversations.

Method

Data were obtained by recording focus group discussions, which were then transcribed and subsequently analysed using Leximancer. During the course of the analysis, and after, I reflected on the subjective usefulness of Leximancer for analysing science communication focus group conversations, and particularly for eliciting values in such conversations.

Participants

In March 2010, twenty-four of Australia’s leading farmers from across the meat, cropping, dairy, sugar, bee keeping, wine and wool industries met in Canberra for a two-day induction into a group to be known as “Climate Champions”. The Climate Champions program was established in recognition of the role of peer interaction in how farmers gain new knowledge and adopt new practices. It aims to put farmers who are knowledgeable about managing and adapting to climate variability and climate change in touch with other farmers. From a science communication research perspective, the Climate Champions program presents a rare opportunity to observe emergent upstream engagement, as the group was asked to define their own objectives and criteria for success before the trajectory of the program was decided.

The program is supported financially by five Rural Research and Development Corporations: Grains Research and Development Corporation, Meat and Livestock Australia, Dairy Australia, Rural Industries and Development Corporation, and Sugar Research and Development Corporation. It also receives communication support from an environmental and science communication consultancy called Econnect Communication, as part of their contracts with the Managing Climate Variability Program—a research funding body funded by the Australian Commonwealth Government, and the Grains Research and Development Corporation's Climate Change Communication Campaign.

As part of the induction to the program, participants were separated into small groups (four to six people) for facilitated discussions. This paper examines two of those conversations in detail.

Focus groups

Facilitators were nominated by the organisers of the event and provided with a facilitator's guide outlining questions for each session. The conversations examined in this paper come from a forty-five minute session designed to elicit participants' responses to three value oriented questions:

- How will you know if the Climate Champions program has been successful?
- What will be different because of the Climate Champion program?
- What will be the value of Climate Champions?

Facilitators for the two groups used in this study consisted of 'K' from one of the sponsor organisations and myself, 'M'.

Leximancer analysis

One of Leximancer's most appealing features is that it enables the user to automatically identify significant themes (i.e., words with the greatest number of relationships to other words) and concepts (i.e., words that occur frequently) in text without any prior knowledge of its contents. With this in mind, I wanted to know what themes (i.e., potential values) would emerge from analysis of the conversations—both taken together as part of the upstream engagement as a whole, and considered separately. What were the potential values for both groups together? And what were the potential values for each of the groups?

In addition, I wanted to learn about Leximancer's ability to account for the influence of context in conversation. Did it matter if turns in speech were represented sequentially? Would there be a difference in results if facilitator and participant speech were extracted from one transcript to produce two and then combined in Leximancer, compared to leaving the transcript intact (i.e., speech combined contextually)?

To explore these questions, transcripts from two of the Climate Champions focus groups were loaded into Leximancer v3.5, and compared in the ways described above. The standard options were selected, as well as "merge word variants" (e.g., communicate and communicating) and "apply dialog tags" (i.e., M: and K: to denote who is speaking) selected. Transcripts were parsed to produce separate transcripts for each of the facilitator's speech and each group's speech (i.e., six transcripts in total: M's transcript intact, K's transcript intact, M's speech alone, K's speech alone, M's group's speech alone and M's group's speech alone).

Concept maps for each of the analysed conditions were generated (shown in Section 3 below) under default viewing conditions (i.e., none of the sliders controlling detail have been adjusted). Labelled circles denote "themes"—larger circles are considered main themes and colours are assigned randomly. These "themes" are generated by related "concepts" identified in the text, which are denoted by dots within the circles. Lines connecting the dots denote pathways in the text between concepts. For the purposes of this study, I will focus on the comparison of themes, as I am investigating the possible use of themes as potential "values".

Some may consider the level of analysis performed in this study to be rudimentary. Indeed, Leximancer is equipped with more features and options than what will be discussed here. However, by adhering to Leximancer's more basic features, I am both minimising researcher influence on the outcomes of the data, and simulating a realistic level of knowledge that other science communicators might be likely to acquire after undertaking a similar degree of introductory training as I had, or less.

Findings

Analysis of two groups combined

Leximancer concept maps may be useful for gaining a sense of the content of text, without actually knowing what it contains. Figure 1 below shows the concept map generated for both group transcripts in this study, analysed together. Results show four main themes encompassing many concepts (i.e., relatively larger circles): “change”, “people”, “research” and “successful”; and seven other themes (i.e., relatively smaller circles): “farm”, “time”, “terms”, “management”, “year”, “saying” and “cause”.

Figure 1. Concept map for all group data (both transcripts) in context

In this study, I was interested in the themes that emerged as potential values in the conversations. In observing the interactions during meeting, facilitating one group and transcribing the recordings, I was familiar with some of the content and was able to make some decisions about acceptance criteria for themes as “values” in the conversation. For example, the themes “cause”, “saying” and “terms” from Figure 1 seemed like inappropriate values for the conversations, and so I decided to investigate this assumption further.

I noticed that two of these suspicious themes—“saying” and “cause”—are located in the periphery of the cluster and not touching or overlapping any of the other themes in Figure 1. These themes could therefore be taken to relate less to the other themes/concepts.

I also looked at the thematic summary (shown in Figure 2), which gives connectivity and relevance ratings for each theme. I noticed that “saying” and “cause” also ranked low in the list in terms of connectivity and relevance.

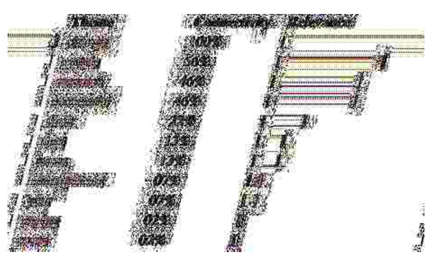

Figure 2. Thematic summary for all group data (both transcripts) in context

Further investigation of these terms in the transcript showed that “cause” was used mainly as an abbreviation for “because” (e.g., “‘cause they’re going to…”) and “saying” was used to describe what was happening in the conversation (e.g., “I was saying…” and “So you are saying…”). This further confirmed my assumption that their suitability as “values” was questionable.

While the theme “terms” ranked more highly in the comparison in Figure 2, the transcript revealed that it was used as part of the expression “in terms of” and was therefore also unlikely to be considered an appropriate “value”.

Leximancer facilitates the exclusion of particular terms in its analysis in at least two ways: words can be added to the default stop list of words that are removed from the analysis prior to generating concepts, or concepts can be removed prior to the generation of themes. However, manipulation of the data in this way introduces user subjectivity, detracting from any claims that might be made about neutrality in making use of Leximancer. Furthermore, the removal of concepts may not elicit more refined results. For example, removing old concepts may result in new concepts of questionable use to the user, as illustrated in Figure 3 where the concepts “cause”, “saying”, and “terms” (i.e., inappropriate values) were removed from the emergent concept list.

Figure 3. Concept map for all group data (both transcripts) in context, "cause", "saying" and "terms" removed as concepts

While the four original main concepts remained (i.e., "change", "research", "people" and "successful"), the relative size of "successful" decreased. New themes that might be considered useful potential values were added: "Climate Champions" and "money"; however, new themes that are unlikely to be useful as values also emerged: "bloody" and "stuff".

Comparison of two groups analysed separately

Leximancer concept maps may be useful for comparing the content of two texts, without actually knowing what they contain. For example, Figures 4 and 5 below show the concept maps generated for each of the group transcripts in this study, analysed separately.

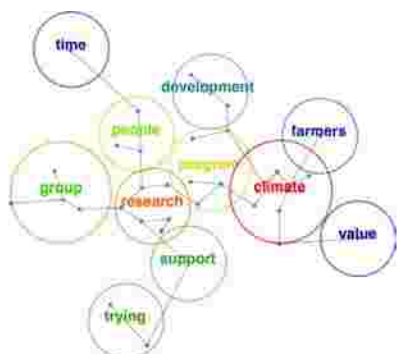

Figure 4. K group in context

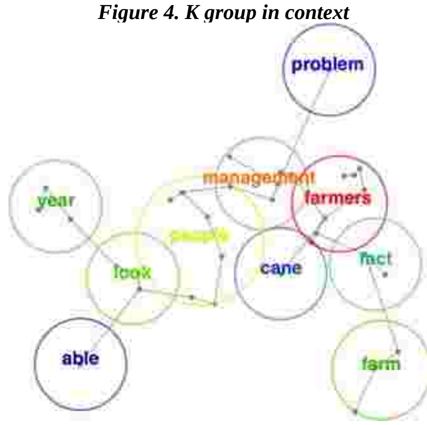

Figure 5. M group in context

At a glance, a comparison between the two groups showed few circles with the same labels, suggesting few similarities. However, a perfunctory explanation of each of the texts could be produced using some of its themes. For example, "something about developing a research program having to do with farmers and the climate" for K group and "something about cane farmers using facts for farm management" for M group. While these clusters of themes provide a sense of the topic of the conversations, without prior knowledge about what occurred in the transcripts, it would be difficult to know how representative such stories might be.

Concept maps could be used for more direct comparisons of the data. For example, Table 1 below was produced to show a simple comparison between the themes of both groups.

Table 1. Comparing themes between groups

Comparison	Themes
Common themes	"people", "farmers"
Similar themes	"time" (K)/ "year" (M), "trying" (K)/ "able" (M)
Uncommon themes	(K) - "climate", "research", "program", "group", "support", "develop- ment", "time"
	(M) - "management", "look", "farm", "fact", "cane", "able", "prob- lem"

In constructing the table, I could reason why some themes were common, similar and different. However, without knowing the context that each of these terms was used, it would be difficult to know whether "people" was a common theme for both groups for the same reasons or whether uncommon themes were really uncommon or describing similar things (e.g., "research" and "look").

What was particularly interesting were the differences between themes in M group and K group taken separately (as in Figures 4 and 5), and then combined (Figure 1). Some of the main concepts stayed the same (e.g., "people" and "research"), while others were lost and/or were replaced by new themes (e.g., "climate" and "program" were lost, while "change" and "successful" were gained). Instead of having all the themes from each of the conversations as a contributing theme in the combined analysis, some kind of mediation had occurred and a more refined concept map resulted. In other words, individual speech contributions did not maintain their prominence when combined with other contributions.

The influence of context

In addition to mediation of contributions by members of different groups, Leximancer may be sensitive to context (e.g., ordering of turns in speech) in conversation. To investigate this sensitivity, I separated speech contributions from the facilitators of each group from the group contributions, and then analysed the four transcripts together to produce the concept map in Figure 6 below. Note that the text itself is the same text as was used to generate Figure 1, but in this case, the contributions were considered out of context (i.e., not in general "facilitator question - participant answer" format).

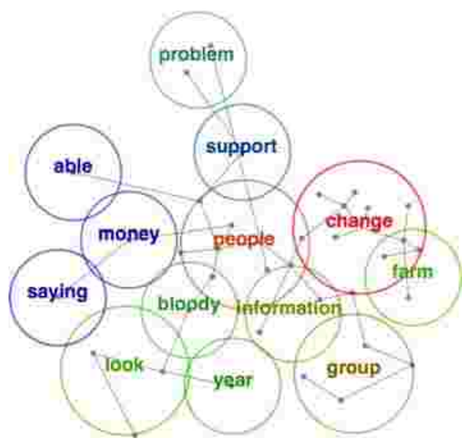

Figure 6. Concept map for all group data (both transcripts) out of context

A comparison between Figures 1 and 6 showed a slight refinement (i.e., fewer number) of themes when the transcripts were taken in context. Once again, the results of the combined data gave a sense of mediation within the conversation. For example, adjectives like "bloody" and directives like "look" may have been important in the conversation rhetorically, but did not contribute to the themes when taken in context.

Discussion

The combined results of these comparisons in the analysis lead to a few observations about the use of Leximancer to analyse focus group conversations.

First, the extent to which Leximancer may be considered useful as a tool depends on what it is being used for. Leximancer aims to help the analyst avoid fixation on potentially atypical or anecdotal evidence by making them aware of the broader context and significance of concepts (5). Analysers invariably approach their data with expectations and prior assumptions about their meaning. Leximancer provides them with the opportunity to quickly test their assumptions. For example, many of the themes I would have initially expected to be important in the transcripts in this study (e.g., policy making and funding) were missing from the Leximancer analysis, while other themes (e.g., money and year) were unexpected. Leximancer offers a way to test assumptions about data like these, and be challenged by the results. In this way, analysts can widen their own value-lenses and be reflexive in their analysis.

Second, Leximancer's usefulness for analysing focus group conversations is limited by the user's understanding of its operation. The way that I have described its use here—to perform a cursory investigation through its default settings—leads to a very superficial understanding of the data. While it is possible to gather the essence of a conversation using basic features in Leximancer, doing so does not provide a particularly meaningful analysis on its own. It is difficult to make sense of the themes in Leximancer without an understanding of who is saying what, and in what context. For example, in this study, it is not sufficient to have the theme "research" (which is both a noun and a verb) without knowing that the term was generally used to describe the farmers' desire to participate in research and give feedback to researchers. Likewise, themes cannot be compared between groups without an understanding of how those themes emerged (e.g., "terms" as part of the expression "in terms of").

While Leximancer can be configured to perform a more in-depth investigation than what has been described here, there are tradeoffs for users who engage Leximancer's more advanced features for analysing focus group conversations. Not unlike traditional, non-automated qualitative analyses, users should be aware that their own values influence what they consider to be important in the conversation they are examining. Leximancer offers a variety of ways to explore this influence—from choosing words to be included and excluded, to considering certain combinations of words and numbers of lines. For example, in further iterations of the analysis described in this study, I would exclude words such as "stuff" and "bloody" because they are not themes that I am interested in. However, in doing so, I would be detracting from one of Leximancer's main strengths: the ability to limit the influence of researcher bias to produce themes from data.

Thirdly, from the comparisons in this paper, I believe that Leximancer does have some sensitivity to the influence of context, albeit not in the way that users might like it to have. There was a difference in results when facilitator and group speech were separated and then analysed, but to what degree this analysis is able to account for the flow of conversation (e.g., facilitator question – participant answer) is not clear from this study.

Finally, in examining Leximancer's ability to extract values, I think its strengths lie in its use as a tool for reflexivity. In this analysis, consideration of themes as potential values was useful only insofar as I was able to use my own judgement about what might suitably be considered a value.

In summary, while Leximancer appears to be a useful data-mining tool, it may not serve as a substitute for traditional thematic analysis of conversations when used in the way I have described. However, Leximancer analyses may add value to traditional transcript analysis techniques, even if it might not replace them.

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122. Communicating Science via Art Installations

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Abstract. Science is part of our everyday lives, and so is art. Particularly, art installations require an active presence; thereby they contribute to the raise of awareness, promote understanding, and generate an emotional response. This project seeks to explore the connection between art installations and science communication through experiential learning. The sample for this study consisted on two groups of participants. One was exposed to a list of scientific facts, the second one contributed in the creation of an art installation. The results as a whole, suggest that art installations does aide in long term fact retention. Therefore, the creation of art installations can be considered an interesting media to convey science in an attractive, reliable, and memorable way.

Keywords: AEIOU, Art installation, Experiential learning, RIRC method

Introduction

Science is one of the disciplines that is constantly struggling to achieve a better diffusion of its knowledge. We are conscious of the difficulty encountered in achieving the above goal. It is because of this that sometimes, the public becomes discouraged in its attempt to penetrate the scientific world and erroneously avoids the topics that are of great significance to the evolution and development of the world. In light of this, how can we foster an interest in scientific knowledge? How can we construct a bridge between science and society in general? How can scientific knowledge be part of our culture and daily experience?

It is important to mention that in recent years, education has become a multidirectional, inter-disciplinary process, in which different subjects try to give an explanation of the world that surrounds us. Science is no exception; discovering common elements with other disciplines will facilitate the communication of scientific knowledge and values in a way that is easy assimilated.

With the goal of bridging the gap between science and public, the following investigation rests on two fundamental axes: experiential learning and artistic "installation."

Experiential learning

Experiential learning alludes to one of the most important methods of knowledge acquisition, in which sensory experience, imagination, and long-term memory construction play a pivotal role. If we recall Aristotle, the first experience revolves around the senses. Later on, a process of repetition and abstraction of ideas is carried out, in which once having interacted with the images that are created by the imagination, sensory experience becomes intelligible to create knowledge. One of the advantages of experiential learning is that it achieves not only short-term, but long-term knowledge acquisition.

The cognitive process involves making connections, exploring patterns and capturing the big picture with all of its details. One of the elements that help the memory retain information is the mnemonic system. This refers to the process of the mental association of ideas; it involves schemes, systematic exercises, and repetitions in order to facilitate the process of memorization. (O'Brian 2000) The mnemotic system also uses visual aid to establish associations easy to be remembered. We often discover that mental images last longer than facts. The capacity of the human mind to remember images is generally larger than that of remembering words. The imagination is the way of mentally representing a sensation, and the memory is the way of retaining it. As Einstein once said, "Visual images are the antechamber of words."

The psychologist Carl Rogers distinguishes learning in two different types: the cognitive (insignificant) and the experiential (significant). The first corresponds to academic knowledge such as the learning of Spelling lists or multiplication tables. The second refers to applied knowledge: such as learning about motors in order to repair an automobile. The key to the distinction is that experiential learning takes into account the needs and desires of the public.

According to Rogers, learning is simplified when the student completely participates in the process, has control of, and can direct, his or her learning. It is important that the participant confronts the information with social or personal experiences. Finally, self-evaluation will be the principal method to obtain successful results. Rogers emphasizes the importance of always being open to change in order to update and generate new knowledge. (Rogers 1969)

Art installations

Art, specifically postmodern contemporary art, is starting to take force as a learning tool in education institutions. The ways in which it is applied are different; nevertheless, there exists a pronounced line that consists in involving feelings, emotions, creativity, and knowledge in only one process in order to reinforce cognitive learning. (B. 2006) Art motivates the student to learn and helps him or her to develop higher-order thinking skills. (O'Farrell 1994) Art is valuable since it encourages different forms of human intelligence; it can fulfill the purpose of both entertainment and education. (Gardner 1983) The creation of art results in the conjunction of information with the imagination; this way the audience uniquely conceptualizes the represented reality.

Artistic installation is a contemporary art genre that began to take a strong hold in the artistic community beginning in 1970. The installations incorporate many artistic mediums to create a visceral or conceptual experience in a determined environment. In general, artists of installations incorporate the demonstration space, using it like another element of the work; whether they are public spaces, museums, art galleries, or even urban spaces.

An art installation is an expression that is realized in a multidisciplinary and multisensory approach. It consists of a work in which its creation is part of the technique and also of the ultimate expression, involving the active presence and participation of the spectator. (Morales Morales 2009) This active presence is what interests us as a participatory element in the diffusion of scientific topics. For a long time, science lived behind laboratory walls, but today, it is not only necessary for people to understand it, but to take possession of it, to live it and to experience it, and to express an opinion regarding its role in everyday life.

The importance of using artistic installations as a medium of scientific diffusion is founded in two elements. First, it turns the public into an active participant in the creation and conceptualization of the work of art; therefore the public acquires experiential learning. The flexibility characterized by artistic installations permits themes or topics to be expressed in different forms, textures, sounds, sizes, smells and colors, emphasizing the importance of a first sensory approach. In this way multisensory learning is adapted and internalized by the participant.

The second factor is that we recapture one of the forms previously used in the comprehension of scientific topics: AEIOU learning (this term was developed by T. W. Burns, D. J. O'Connor and S. M. Stocklmayer in "Science Communication: a Contemporary Definition").

AEIOU learning

Scientific communication (SciCom) is defined as the use of skills, means, activities, and dialogues adapted to produce one or more of the following personal responses towards science: Awareness, Enjoyment, Interest, Opinion-forming and Understanding. (T.W.Burns 2003) The diffusion of science through artistic installation seeks to incorporate the five components through a process of active participation and scientific information that have been conceptualized in an artistically-designed expression. This type of communication seeks, through an existential metaphor, to design a bridge between imagination and critical thought, as well as between the public and science. The result is a rational opinion, which, thanks to the metaphor, alludes to conscience forming regarding the topic.

The practical section of this investigation includes the previous design, and the creation of an artistic installation that conceptualizes, in this case, the topic of environmental deterioration and the consequences of the cycle of consumption. To carry out the project and to measure the level of acquisition of scientific knowledge, two groups were formed: a control group called the factual group and another group called the art installation group. The first group was exposed to information related to the topic of the deterioration of the planet Earth. The installation group had access to this information while at the same time, created an installation where each material and form represented one of the facts.

RIRC method

It is important to use a method that helps us analyze the effectiveness of science communication via art installations. This way results can be measured, and according to the analyzed data we can think of better ways to improve the stimulus. In this case, we used the RIRC method (A. y. Negrete 2010) to evaluate the comprehension and retention of scientific knowledge. RIRC method uses three tasks to measure explicit memory (involves a conscious recollection of data): declarative knowledge, recognition, and recall. The method also includes a task that measures implicit memory (involves the use of previous experiences that are not consciously recollected): procedural knowledge.

Declarative knowledge refers to facts being recalled, recognition implies identifying elements that were previously learned, and recall is about producing a fact, words or a story that has been retained in our memory. Finally, the tasks that involve procedural knowledge are those in which abilities or behaviors are learned and can be remembered. These groups of memory tasks were designed in order to measure how the public learns and retains information, as well as the different levels of understanding the provided information. (A. y. Negrete 2010)

The RIRC method was originally used to compare and contrast the performance of public exposed to scientific facts using narrative forms. Due to the characteristics of an art installation, the use of different forms, odors and materials, help create different ways of understanding and perceiving the information. The part regarding Opinion-forming (represents the "O" in the AEIOU method) differs from participant to participant it is important to analyze the way in which consciousness is address by each one of them. The art installation had an extra task involving procedural knowledge in order to understand the relation established between facts and the art installation concepts.

Objectives

1. Explore the possibility of art installations as a media to communicate scientific knowledge.
2. Compare and contrast how participants understand and remember information from a list of facts and through experiential learning.
3. Develop opinion forming through a meaningful sensorial experience in order to obtain a personal consciousness about, in this case, environment deterioration.

Stimuli Development

The objective of this section is to fully explain the process in which the stimulus was presented to each group. From now on, we will refer to the first group as the "factual group" and the second group as the "art installation group". The factual group was exposed to a list of scientific facts. The art installation group participated in the creation of an art installation while scientific facts were provided to them. Each group was composed of 17 participants between the ages of 20 to 23, all of them current students.

During the first session, the factual group was exposed to a list of ten scientific facts concerning environmental deterioration. (Table 1) After ten minutes, a questionnaire (the characteristics of the questionnaire will be explained further on) was handed to them and had fifteen minutes to complete it. The second group assembled an art installation following a specific procedure. The group was divided in 3 teams: green, black, and yellow. Each one of them had a specific task during the construction process. A procedure sheet (Table 2) and a diagram (Fig. 1) were given to each team describing the assembly process, as well as the responsibilities for each one of them. After the installation was completed they were asked to answer the same questionnaire as did the factual group.

Methodology

The questionnaire applied incorporated 4 different tasks to fulfill the requirements of the RIRC Method.

Table 1. Scientific facts
This is part of the evolution process of human being on Earth. Are we doing things the right way?
The Earth was formed 4.5 millions of years ago.
The "homo" appeared 2.5 millions of years ago in the Paleolithic period.
A great part of humans existence is known thanks to art expressions. This is how the human being has left its mark.
Since the first half of the XX century, the human being has been considered the greatest super-predator in habiting the planet Earth.
We have finished with the 80% of forests on this planet.
Each person produces 2 kg of garbage every day.
If every country would consume the way the United States of America does, we would need 5 planets to get enough resources.

In the past 30 years, we have terminated with 33% of the natural resources on the planet.
Our economy demands us to consume. Buying has become a ritual to achieve spiritual satisfaction.
The process of buying things is resumed in 5 main steps: Extraction–production–distribution–consumption–disposal.

Table 2. Resumed procedure
(EVERYONE) Arrival to the meeting point. Leave your shoes in the black corner. In the patio, you will find a specific shape made out of masking tape. Recognize it and form a circle around it of approximately 10 m. of diameter. Each team will remain together, pick a leader. Identify, using the diagram sheet provided, the location of the pile of leaves, the recycled garbage, and the shoe pile.
(GREEN TEAM) Each integrant will pick as much leaves as possible from the leaves pile. They will be placed as shown in the diagram. When you are done, the leader will raise his hand and the team will return to the circle.
(BLACK TEAM) Each integrant will pick several pairs of shoes from the shoe pile. They will be placed as shown in the diagram. When you are done, the leader will raise his hand and the team will return to the circle.
(YELLOW TEAM) Each integrant will pick several cans and bottles from the recycled garbage pile. They will be placed as shown in the diagram. When you are done, the leader will raise his hand and the team will return to the circle.
(EVERYONE) Make sure the figure is exactly the same as shown in the diagram, make any adjustments if necessary.

One question involved the free-recall task (Retell): Mention all the facts that you can recall from the given information. A five item list of the most important concepts was established that enclosed the given scientific facts. The maximum points for this task were 5.

For the recognition task (Identify), 3 multiple choice questions were designed. Therefore,

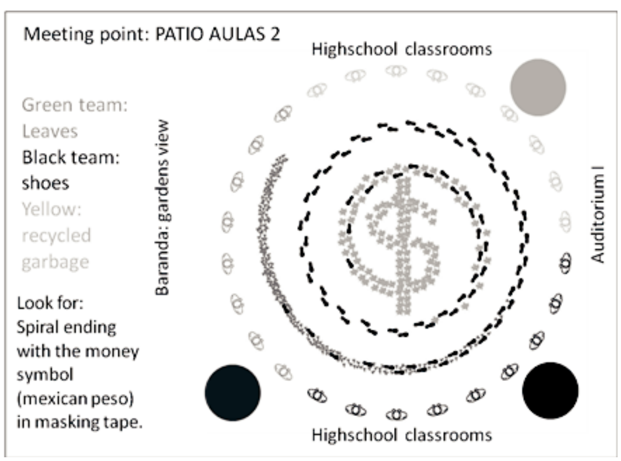

Figure 1. Diagram the maximum possible points for this task were 3.

In order to have an optimal answer the participant should have been able to identify the mentioned fact from a series of possible options.

For the recall (Remember), two types of questions were considered: short answer and fill in the blank. This kind of tasks helps to measure the information that can be produced using explicit memory. The maximum possible points for this part were 4.

Question number 9 refers to the procedural knowledge task (Contextualize). The objective of this question was to create a different context, and measure the ability of the participants to apply learned facts in a specific situation. This task is connected to opinion-forming and gaining consciousness.

An extra question concerning also procedural knowledge was applied to the art installation group. Its purpose was to identify the ability of participants to refer scientific facts to material, forms, and colors in the installation. Most art installations intend to provoke an emotion, feeling or sensation among the public. The art installation should have helped them reinforce the retention of scientific facts throughout the senses of sight, smell, touch and hearing.

Results

The results suggest that the factual group had a better performance during the first session compared to the art installation group. The factual group had better results in the four applied tasks, and in general terms the standard deviation of the art installation group was lower that the factual one. (Table 3)

In the second session we could observe differences in the way scientific information was retained. During this session the art installation group had better results in all four tasks. Furthermore, the results between art installation and factual group performance during session 2 are much more apart, than the results obtained in the first session. Although the general standard deviation in the art installation group during the second session is lower, we can observe that in most of the tasks the factual group maintained better homogeneity in 3 out of 4 different tasks. (Table 4)

Table 3. Performance during session 1

	Retell	Identify	Remember	Context	Total
FACTUAL GROUP					
Optimal answer %	58%	78%	75%	59%	67%
Standard deviation	1.65	0.79	1.12	0.75	2.89
ART INSTALLATION GROUP					
Optimal answer %	46%	76%	65%	53%	58%
Standard deviation	1.69	0.69	0.94	0.62	2.54

In the case of the factual group we observe that over time the retained information is lost, especially in the tasks that measure explicit memory. In this area the factual group experienced diminishes of 37% on the number of optimal answers. In the procedural knowledge task the results maintained, but we could also perceive that the standard deviation increased. In the art installation group the results of the second session suggest an improved performance. For the explicit memory tasks, the optimal answers were superior in 17% exceeding the results of the ones of the first session.

The greatest achievement for the art installation group was observed in the procedural knowledge task with a 23% improvement.

Table 4. Performance during session 2

	Retell	Identify	Remember	Context	Total
FACTUAL GROUP					
Optimal answer %	31%	55%	47%	59%	45%
Standard deviation	1.84	0.86	0.86	1.03	2.90
ART INSTALLATION GROUP					
Optimal answer %	65%	86%	68%	76%	72%
Standard deviation	1.89	0.94	1.05	0.85	2.48

The general results imply an upgrading in the performance of the art installation group, while the number of optimal answers diminished in the factual group. The standard deviation data had a similar behavior. In the factual group, results from session 1 to session 2 mostly maintained the same; a slightly higher dispersion is observed. The results for the art installation group show that the standard deviation diminished during session 2. The dispersion of the data suggest that while information presented with a list of scientific facts loses accuracy and uniformity over time,

the information presented via art installation gains accuracy as well as homogeneity. The results obtained imply that art installations help enhance scientific knowledge.

In addition, question 10 was used to measure how much of the given information was successfully related to the art installation work. Participants in the art installation group with higher overall results on the 4 required tasks demonstrated a better connection of scientific data to art installation concepts.

Conclusion

The results of this study as a whole, suggest that art installations does aid in long term fact retention; knowledge. (Fig. 2) Therefore, the creation of art installations can be considered an interesting media to convey science in an attractive, reliable, and memorable way. Using the RIRC method gave us the opportunity to analyze quantitatively and qualitatively. This allows having more accurate measurements of the outcome, and encourages compare and contrast analysis.

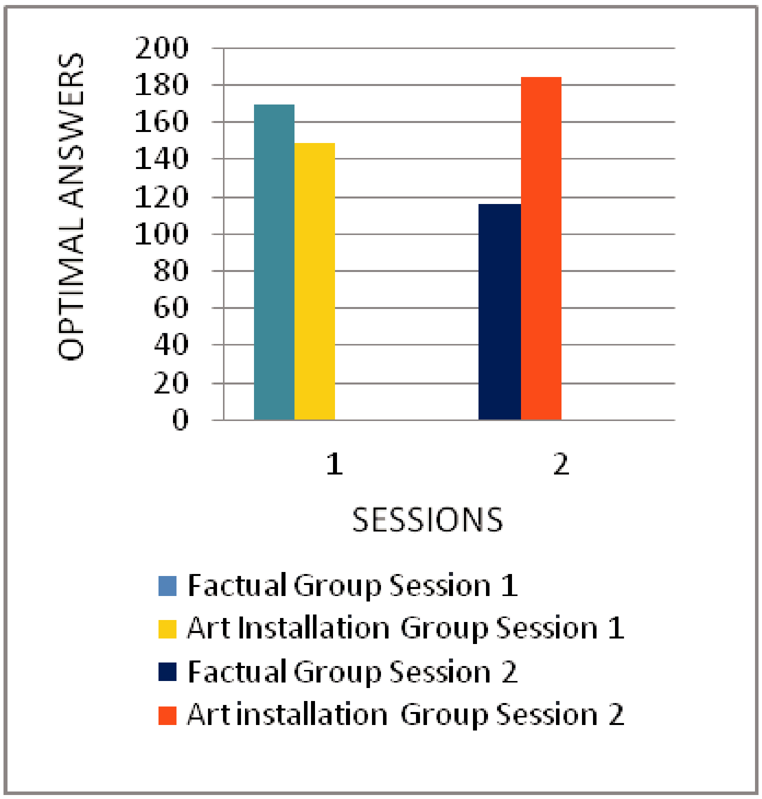

Figure 2. Session 1 & 2 Overall Results

One of the most important aspects that should be emphasized in this investigation is the ability of art installations to sensitize the participants experiencing different objects, feeling them, smelling and hearing scientific information at the same time. Different experiences are perceived, for instance, it is not the same to smell green fresh leaves, than to smell recycled cans and plastic bottles. The objective of experiential learning was reached when the participants' senses were stimulated and a greater impact was produced. Results suggest that this way, information is more accurately retained through time.

Carrying out this investigation resulted in a very insightful experience. The art installation group participants were able to connect facts with the items, forms and colors presented in the art installation. When the communicating process is not only addressed but developed by the public, a different kind of awareness is created. Each participant was able to acquire knowledge in its own specific way; therefore they had a unique opinion-forming during the activity. The ability of a person to develop consciousness is what gives facts an extra value; it is not just about retaining information, but of being able to use it in different situations.

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123. Engaging Users in Science and Technology Exhibition CoDesign Online and Offline: the Expolab Experience.

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Abstract. We present Expolab, an experiment on user involvement in science and technology exhibition creation, a joint project of the science communication company La Mandarina de Newton, Citilab (Barcelona) and The Tech Museum in San Jose, California. The project explores novel practical methods for science and technology centres and museums, to become active hubs of citizen involvement and engaging people in science and technology. The approach mixes research, communication and design. It also combines methods that work on a face-to-face basis and the utilization of collaborative Web 2.0 technologies and virtual collaborative 3D environments to develop exhibits with users.

Keywords: Museums, Participation, Co-design, Engagement

Introduction

Science and Technology Museums, like many other museums, are posed with important difficulties to engage their audience in the knowledge they treasure and, in that way, be able to become active hubs for knowledge sharing and learning (1).

The arrival of social media was hailed by many museums as an opportunity to relate in a different way to their audiences (2) and as lever of engagement, replicating similar old claims when the arrival of the web impacted the cultural sector (3). In fact, there is a connection between Web 2.0 technologies and active engagement (4). Museum audiences familiar with 2.0 technologies are, for example, more active in the sense that they read and write more online and offline than the average population and regular museum visitors (5). So, these audiences expect from the institutions to be given a more active role than just being recipients of information and are willing to become more involved. This is a great challenge for current museum strategies (6,7).

Web 2.0 technologies have helped museums realize the possibilities of new participatory projects to engage people in museums' goals, contents and activities. Many of these projects turn the museum into a social aggregator of media and content, either provided by users or remixed by themselves from whatever contents the museum opened for free use. Hopefully, these projects result in an increased social interaction between visitors. This may lead to mutual dialogue and reflection on the museum contents. Some authors (8) make this last claim explicitly. However, participation has many levels and it doesn't necessarily need to be done only through technological means alone.

In fact, initiatives that are too directly inspired by the use of Web 2.0 technologies and their underlying philosophy as their only form of participation tend to exploit just one possible way of engagement: that of letting people contribute with contents, ideas and discussion which, nevertheless, is a very valuable result in itself. They also may be biased towards visitors with some technological background.

Looking for an alternative to exploit the collective aspect of participation, museums can also explore a tradition of collective learning by construction and collaboration that speaks to active users too (9). For example, The Tech Museum pioneered this approach in participation by letting users design exhibits in response to a design brief –a call to create a specific sort of exhibit- by the museum. A precise invitation to create a single type of exhibit was done. Tech Virtual (10), as this initiative is called, has been running for several years now and it is a successful way to engage people in learning about Science and Technology.

Participation as shared learning through construction requires users to become designers. Participation in design and learning is a laddered experience (11). So, one interesting question is what it would be like to go one step further up the ladder and let users co-design a whole exhibition, without an initial exhibit brief, i.e., giving them the chance to decide topics of the exhibition and then co-design it.

The importance of design in Science Communication as a means to improve the presentation and the visualization of Science and Technology communication projects has already been stressed within the Science Communication research community (12). We want to remark here another concept of design where it is not only seen as an ancillary discipline used to improve visual or aesthetic aspects and as a result increase communication effectiveness. Instead, it is taken as a means to draw the users into the actual creation of the object to be designed and, in this way, reach the core of the message the museum is trying to convey. In order to confront such a challenge, it is interesting to resort to user-centric design methods. Design began to involve users long ago. First, as individuals to be observed (13) then, gradually letting them become co-designers (14,15). Slowly, this approach has arrived also to museums (16,17).

We wanted to test user-centric co-design methods, combined with 2.0 virtual platforms (18), and check its use in the definition of a whole exhibition centred on Science and Technology concepts. This is how the exhibition “From contemplation to participation and beyond”, came into being within the Expolab project.

The Expolab process

The Expolab project was created and coordinated by the Science and Technology communication company La Mandarina de Newton in Barcelona. It received the support of The Tech Museum in San Jose, California, and the civic community innovation center Citilab in Cornellà, Barcelona.

The goals of the project were multiple. In a typical design research approach, it started by devising a design research process centred on a clear artefact. The artefact was to be used as a sandbox to test and learn design and communication methods as well as their relationship to 2.0 technologies.

The artefact to be built was an exhibition. The exhibition, although it is a format or genre under much discussion within the museum community (19), still is the flagship of museums. That is why it became our object of choice to test design-based approaches in Science and Technology in museums. The subject of the exhibition was initially defined very ambiguously so that the participants, actual co-designers of the exhibition, could refine and elaborate by themselves the focus, the content, and the actual exhibits.

The institutions giving support to the project were related to innovation in digital technologies. The Tech Museum is in the heart of Silicon Valley. Citilab’s main activity is training citizens in Internet skills. So, the focus of the exhibition was initially vaguely defined as “Internet and what it has brought about”.

We also wanted to explore and investigate if users could design in a more complex sense than just giving shape to the physical appearance of objects. Exhibition design incorporates much more than that (20). In this case, it was felt that in order to connect with the Science Communication tradition in museums, it was important to use the exhibition as a metaexhibition. That is, to explore, show and reflect on the different approaches to Science and Technology exhibition design over time.

The current predominant mainstream approach to Science and Technology museums is the “interactive museum”. It can be traced back to the influential work of Frank Oppenheimer in creating the Exploratorium (21). This was a significant departure from old “contemplative” museums based on the display of object collections, including scientific apparatuses as objects. Instead, Oppenheimer introduced the important concept of experimentation on the scientific phenomenon as the basis for exhibit design. The interactive exhibits in this type of museums initiated a path towards participation, since they require some action on the part of the visitor, which can be taken as a first level of participation. Nevertheless, these exhibits are not always geared towards actual contribution of content or explicitly shared knowledge by the user with other users in the way that, for example, Web 2.0 technologies allow.

The project team proposed as a general constraint for the citizen co-designers that the actual exhibits should integrate (a) a contemplative, passive display of objects related to the subject of the exhibit (b) some form of interaction to explain the science and technology concepts, phenomena and processes around which the exhibit was built and (c) an invitation to other users to contribute content and knowledge to be shared.

In terms of participatory design methods this bundling of different approaches into a single exhibit also posed a challenge, since it involved co-designers in creating something more than a passive object. In fact, the whole exhibition could be seen as a complex system which included personal and social relationships in its design. It also had some reflexivity: citizen co-designers themselves could become eventual visitors. So, they had to think in very complex terms and engage in some level of organizational design. This is at the cutting edge of co-design methods

(22). An added level of complexity is that was an international project with institutions of different competences, in different cultural backgrounds. With all these considerations in mind, the project team sketched the design process to be initiated and also the important research dimensions to be explored:

1. Can non-experts design a quality exhibition of a science and technology subject? There is evidence in favour of this hypothesis in art (23).
2. Which subjects would people suggest?
3. What are the pros and cons of engaging participants from all over the world?
4. What is the response of the public towards the process? What are their main motivations to participate?
5. How should we change design methods to involve plain citizens in complex system co-design?
6. What are the difficulties and advantages to combine offline and online virtual collaboration design workshops?

This last question was especially important since the collaboration had a necessary online component, given the geographical distribution of the design and user teams. Also, it was one asset of the project, due to the experience of the Tech Museum in exhibit design through its Tech Virtual system. It, however, evolved as an online collaboration platform, without offline design sessions.

The test design process that we devised initially was a variation of a well-proven methodology for design that uses a generative step, where new ideas are created, followed by a design analytic step and finished by a synthesis into precise, implementable proposals. The envisaged result was expected to be a workable design description for a whole exhibition, clear and detailed enough to proceed to the construction phase. It was meant to be offered under an open Creative Commons licence. Any museum in the world, or any other group for that matter, could use it to actually build the corresponding exhibits. In the following we describe in linear fashion the phases of the project.

Invitation to participate

In order to start the co-design and construction process of "From contemplation to participation and beyond", we looked for communities of interest. In our case, we made an open call using social networks such as Facebook, Twitter, blog networks and also newsletters, personal mailing, and the Citilab and the Tech Virtual websites to let people know we were starting a new project and to call for their participation.

Face to face workshops

We organised three workshops answering to a significant question: "How has the Internet changed your life?" The formulation of this question was very important. It was related to the still ambiguous topic of the exhibition but, although it was precise, it still was very open-ended and made a direct appeal to personal day-to-day experience, which is a well-proven strategy in Science Communication to gather attention and initiate engagement in the public (24).

The workshops were generative co-ideation sessions. During a typical three-hour session participants worked hands-on with issues related to the impact of Internet in their lives. The design language tools were a set of cardboard, clay, wool and cotton threads, wooden pieces and LEGO™ bricks. The significant question that we launched helped in focusing the attention of the users and gave them some hint of what the possible areas of the exhibition could be. During the workshops we used different techniques to lead them into divergent, generative thinking and convergent construction. We describe them in the following.

Collage making: This technique consists in creating collages in order to obtain latent knowledge from participants. It was mainly used to warm them up. Depending on the session, groups between 20 and 40 people shared their memories, anecdotes and experiences about a certain topic. Participants were divided into groups of 4 or 5 people. We provided them with a set of images and we asked them to choose between 2 or 3 photos that they could relate to the initial question of how Internet had changed their lives. They were asked to explain their selection of photos to the rest of their team. Each group created a collage with all the selected photos. Finally, all the groups shared their collages with each other. In this way, co-designers revealed very rich information about their daily life.

Low-tech prototyping: Each group was asked to create a 3D representation of the ideas and anecdotes that had emerged from creating their collages. The objects that they created were the basis for further discussion and many new ideas were generated.

Figure 1. Participant explaining Connections

Constructing objects manually stimulates the most creative part of the brain. This technique helps people express thoughts that are hard to explain in words. Moreover, it forces them to be more precise about their ideas. Although some people tend to think that they may have difficulties in creating 3D models, participants built in thirty minutes very expressive prototypes.

Analysis

After the workshops finished, the project team worked hard on the analysis of all the generated data. All workshops were recorded. We had videos, collages, low-tech prototypes, photos and information that collected in situ. To evaluate them, these techniques were used:

1. Video recording: All the videos were transcripted. We were able to evaluate the topics that had been more relevant for the participants.
2. Semantic analysis: The meaning of each dialogue and presentation was analyzed.
3. Affinity diagram: We organized ideas and their expressions to find the correlations and identify valuable categories. This technique made sense of expressions by clustering subjects.
4. Word clouds: To better visualise the results of the topic clusters word clouds were created and analyzed. After a couple of weeks, we came out with 5 topics changed by the Internet: memory, connections, work, travelling through time and space and security.

Design brief

From the analysis of the information provided by users and using the constraints about the integration of contemplative, interactive and participatory aspects in the possible exhibits, we prepared a design brief for each topic. Each brief was had six sections: Inspirational anecdote, Science and Technology concept, a sample proposal for the exhibit (volunteered by the team and inspired by the 3D models coming out the sessions), contemplative aspect, participatory aspect and practical technological support. Visit Tech Virtual to see how all these aspects were bundled together in the briefs.

Virtual design

Design briefs were shared on Tech Virtual with a wide community of users who were encouraged to design their own final exhibits fro them. Construction of the exhibits was done virtually in the Second Life virtual world island that the Tech Museum set up for the project. A design contest was open to users in the entire world. It was not a regular competition where the most important factor is the prize and contestants must keep their work secret until the end. It was based on collaboration between designers, dialogue and multiple contributions.

We organised regular weekly virtual meetings in Second Life. Every Thursday we met at 7pm Spanish time, 10am California time, and waited for user avatars to show up in the design space. There were around 10-20 avatars. Participants discussed how exhibition proposals could be improved or the work that had been done during the previous week. Other days, we saw how a new exhibit was created in real time and there was a general interchange of comments on what the co-designers thought about it and the hows and whys of some details were also asked.

Selection

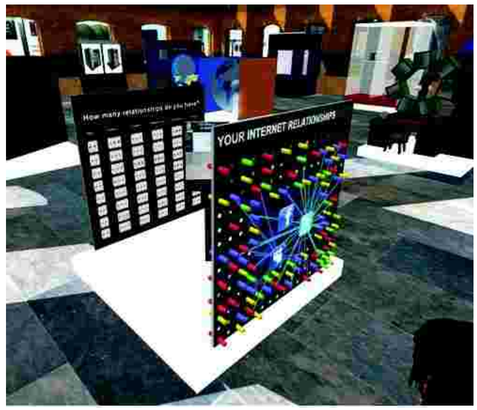

Figure 2. Connexions, the winning exhibit

Up to this point the process had gone through three phases: a first, generative phase, were co-designers explored ideas and used metaphorical 3D prototypes to express what exhibits were to be about and how they could look like; a second, synthesis, convergent phase where design briefs were elicited and, then, a third phase where, again, divergent thinking was expressed by co-designers in the creation of several proposals for each single design brief. There were 15 proposals from people all over the world: USA, England, Vietnam, Spain, etc. After the contest closing date, on April 2010 7th and 8th, there was an on-line and off-line poll. People all over the world could vote for their favourite proposals. The first prize was for Maria Bobes for her “Connexions” proposal. There were four more selected exhibit designs. These were taken as the ones to be used for the final exhibition.

Final exhibit blueprints

The project management team took the virtual design and then it checked it for design requisites. Last final steps to ensure visual coherence of the whole exhibition, that is, design in its more aesthetic sense. A final translation from Second Life structures into actual feasible exhibit blueprints was performed. That required some decisions about materials, colours, and some solutions that would work in a virtual setting but not in a physical one in a real museum. The virtual blueprints were complemented with measures to make it easier to actually build them. All this was compiled into a document that can be find at the Co-Creating Cultures website (25).

Discussion and Further Work

The first question we posed ourselves was if it were possible for non-experts to design a quality exhibition about Science and Technology subject. The process showed that it is actually possible for people to create such an exhibition. As to quality, measurement is always difficult and subjective but experts on exhibition design were surprised about the quality of the designs created by participants. Also, the project was one of the reasons for the Tech Virtual receiving the 2010 Linden Prize, which may be a hint of quality.

Interestingly enough, the subjects selected in several sessions by people from very different backgrounds were almost always the same: social relationships (connexions), memory (photography), time and space (instantaneity), work patterns, and security. These were in most cases associated to technology and science. Social relationships and its expression in network science were consistently chosen in all sessions offline and online. Users were actively and enthusiastically involved in the process. From qualitative research based on interviews we saw that their most cited reason to participate was “doing something different with people” and “learning new things”.

Multiculturalism seems not to have been a problem, but added to diversity and creativity in mixing different points of view. One could also see a high variance in aesthetic renderings of the same design brief.

The methods that we used from design and co-design strategies were useful to a point and had to be adapted in later workshops in order to make easier for participants to reflect on the involvement and reaction to the overall design by other users. The combination of online and offline collaboration workshops resulted in different publics involved, with some overlapping. Online publics were more global and more technology oriented than the ones attending face to face sessions. One can get local involvement and global reach in this way. The combination of online and offline approaches also pointed to further work on replicating design methods online, so that you can get similar dynamics to face to face sessions but with larger groups online. This, however, requires extensive research on the translation of collaborative design sessions and it will involve further technological and interface design research projects, which are currently being defined.

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124. Taking Science to Common People–A Technology Approach

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Abstract. An attempt is made to take science to common people for developing a scientific temper, humanism and spirit of enquiry. This has to be done in micro as well as macro level for coordinating efforts amongst various scientific bodies, academic institutions, industry and NGOs for the effective exchange and dissemination of scientific information. The science communication programmes should undertake activities including training courses, lectures, audio visual and folk media. With limited resources and multitude of languages, mass science education faces great challenge in delivery and coverage. Due to the paucity of resource persons we are not able to reach the large part of rural mass . Simultaneous coverage of larger audience in one go and mass coverage of people in the remote areas for spreading science literacy, are more complex and difficult.

To resolve the challenges of mass reach, interactive communication model with easily implementable and adaptive approach with broadband technology was tried in BSNL for employees' training delivery. The success story has been brought out as model for the spread of science communication across India.

A server with streaming card and web camera at the headquarters (called Web studio) were connected on to the broadband internet. The server was connected to audio amplifier and a mike was used for broadcast .The server was configured as web server with a website having a small window presenting the resource person video and an application for on line chat and interactivity. This server having hooked on to the broadband network was made available at remote locations having broadband connectivity. The programmes were preplanned and the remote locations were informed beforehand. On the day of programme the resource person will be conducting the lessons at the webstudio. In the remote location the audience will be sitting before the computer connected to the broadband internet logging on to the website through which the current programme is being streamed. This was having interactivity and coverage to all remote hill areas where BSNL persons are stationed and who require training on customer care initiative and technology awareness programmes. This initiative was an all round success on account of the broadband internet presence everywhere , attraction of video impact of the resource person and coverage of BSNL training programmes to thousands of employees in a shorter span of time with cost effective training content.

This cost effective model can be deployed to resolve the need to make science communication activities more effective, both in terms of quality and quantity. By this mode of communication we can make a dent in wiping out superstitions that have prevailed throughout the ages, particularly in tribal areas where literacy levels are low with the help of Self Help Groups and Common Service Centres. Thus great and complex challenges in mass science education can be met with success.

125. Entrepreneurship Development Programme through Science & Technology: A Case Study of Uttarakhand Council

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Abstract. Uttarakhand is a hill State with 93% of the geographic area as hilly terrain and 64% is covered by forest. Its far flung areas are under-developed with bad connectivity to the cities. The development of the remotest place with roads, water, electricity, education, opportunities and dissemination of Scientific and Technological knowledge to the population is expected from the Government of this newly constructed State. In this endeavor of State Government the Uttarakhand Council (a nodal agency of DST, GoI) plays catalytic role for the promotion of Science and Technology in the State and supplement/complement the developmental programmes of the State. In this direction the Council has started multiple programmes with Science Popularization and entrepreneurship development programmes as one of the mandates. Since 60% of the population of State depends on agriculture, entrepreneurship programmes related to food processing, canning and technology development for farmers is an important small scale enterprise. With this in focus, the Council has established 06 Training Research Centres. These Centres act as source for technology dissemination and training of local people to start small enterprises related to processing of fruits juices, vegetables, pickles, fish rearing etc. Beside these, some region specific flowers and herbs are available, whose juices are in high demand. So training to extract and preserve these juices by scientific methods is provided by these TRC’s with their sustainable use. This will not only help farmers to generate an alternate source of income but also provides a way to preserve the perishable items at the source point itself. Along with this the Council has one district coordinator in every district. These district Coordinators are pillar of strength to the functioning and outreach of the Council in remote areas of the State. Through these coordinators the science popularization programmes, technology dissemination programmes, EDP programmes are reaching the far flung areas. These activities has greatly enhanced their economic condition. Under these TRC’s around 12,000 beneficiaries have been given training and are working successfully in the small scale enterprises. Another point to mention here is that these Centres heralds development of improved technologies based on locally available natural resources and improvement of post harvesting techniques with traditional experience and knowledge for commercial requirements. These TRC’s further gain importance owing to their local nature. Since they are located in villages they are able to identify the local needs and hence to provide solution and training for that with the scientific inputs. Since its inception, Council has successfully organized more than 40 entrepreneurship development training programmes throughout the State and have established one Mangal Turbine to solve problem of drinking water, ropeway for connectivity of hilly regions and started River bank filtration projects for providing drinking water in five towns of Uttarakhand.

The paper deals in detail the various initiatives taken by the Council to develop human resource in the State for generating revenue to the farmers in addition to their farming income, entrepreneur development programmes for setting up region specific small scale enterprises and dissemination of scientific and technological knowledge among the masses. In conclusion, we can say the EDP has greatly enhanced the technical human resource of the State and hence economic upliftment of the farmers with development of scientific temper.

126. Role of Science Centers & Science Museums

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Abstract. Science museums have been one of the important means for popular citizens to acquire scientific knowledge. The importance of this matter is undoubted. With times going, especially the Internet's coming, people can gain the scientific knowledge in more and more multiple ways. So it is very urgent to allocate the role of science museums, in specially, the large-scale ones in the science popularization.

Through such items as the advantages and disadvantages of science museums compared with other media, and the difficulties in the internet, and the efforts made from various places, the paper attempts to discuss how the science museum make maximization of its whole function and intensification of the cost in the process of popular science and make it keep on playing an important role in science popularization in new era.

Keywords: Role science museums

127. Virtual and Substantial Vectors in Science and Technology Museum:—Comparison and Analysis of Chinese and Foreign Popular Science Exhibitions

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Abstract. With the development of world science and technology, global exhibition educational programme has entered into a new era. Currently, among 186 countries in the world, Europe, America, Japan and other developed countries have utilized the "4D virtual imaging" as one of the important methods to popularize the science technologies and social conventions. The trend will be completed in a relatively high speed as a consequence of time lapsing and explosive updates in technologies. It can be forecasted in the future. Virtual technology will not only coexist with the entity exhibition but also become a primary educational method.

This paper compares Chinese and Foreign science exhibitions from the aspects such as: the exhibition theories, designs, contents, and the building of circumstances. Try to find the flaws then correct them. At the same time, we have browsed the world famous virtual science and technology museum network, such as New York Science and Technology Museum, Washington Science and Technology Museum, US Astronaut Science and Technology Museum, Lincoln Memorial and so on. We have used statistics to do our research. Meanwhile, we combined these with the reality of our country, analyzed the differences in science technology vectors; audience groups and communication effects. In the future, how to take advantage of new technology to complete science enterprise should be emphasized.

Nowadays, science and technology museums should attract visitors by using novel exhibition methods, The museums can make them perceive the technology and experience the technology from a total different aspect of view. For the purpose of revealing the uniqueness of science, the meanings can not be limited but should be renewed continuously to touch the audiences' senses. The author believes that the combination between virtual and substantial technology is the only path develop in the future.

128. Discussion on the social role of China Science and Technology Museum

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Abstract. With the social progress, public demand for science popularization is getting higher and higher. As an important national science popularization infrastructure, China Science and Technology Museum is facing unprecedented opportunities and challenges. To meet the requirements of the times, continuously strive to raise the standards of our works, and achieve sustainable development, we must accurately locate its social role. Firstly, this paper analyses the goal, features and functions of China Science and Technology Museum. As a non-formal educational institution, China Science and Technology Museum aims at propagating scientific knowledge, disseminating scientific spirit and methods, and promoting scientific thoughts and concepts. It is open, participatory, situational, educational, scientific and interesting for the public. And it has such three basic functions as educational function, service function and support function. Secondly combining with practical work, this paper turns to explore the social role of China Science and Technology Museum. In general, China Science and Technology Museum should be located multiple roles, the explanation is as follows: (1) The disseminator of science knowledge. Propagating scientific knowledge is fundamental function of science and technology museum, China Science and Technology Museum has been developing diversified educational activities on top of perfecting the standing exhibition in past over 20 years, so it is a lifetime classroom for the public. (2) The guide of scientific interest and scientific concepts. Disseminating scientific spirit and methods is even more important than propagating scientific knowledge. With a series of activities, China Science and Technology Museum make public have a good command of science method and skills, and understand the scientific spirit and humanistic spirit. (3) The communicator between the public and the scientists. China Science and Technology Museum tries to encourage technological and cultural exchanges between the public and the scientists, so as to promote the voluntary participation and foster social responsibility of the public. (4) The partner and supporter of other educational systems. Science and technology museum is a useful supplement and extension for school education, China Science and Technology Museum is not only a good place to study for students, but also a helpful place to attend scientific and technical training and improve their ability for teachers. (5) The vanguard and service provider of local science and technology museums in China. China Science and Technology Museum should provide a series service such as consultation and guidance for the local museums. (6) The theory research center for the science and technology museums. Academic research is beneficial to develop high degree of exhibitions and activities, and achieve an advanced class in the world. (7) The collector and exegete of historical collections. As a national museum, China Science and Technology Museum has the duty to preserve and present the historical collections, and promote national science and culture history.

Keywords: China Science and Technology Museum, Science popularization, Social role

129. Biodiversity Conservation Academy: Inspiring South African Undergraduate Science Students to Postgraduate Studies and to Careers in Research Science

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Abstract. The Biodiversity Conservation Academy is a venture by two South African centres of excellence, the Centre for Invasion Biology and the Centre for Birds as Keys to Biodiversity Conservation (based at Stellenbosch University and at the University of Cape Town respectively). The aim of the academy is to mobilize, motivate, and mentor undergraduate science students, particularly those from previously marginalized groups (e.g. black South Africans and women) to take on postgraduate studies and to consider careers in research science.

The South African research landscape is such that most research work is carried on old white shoulders, white males majority of which are nearing retirement age. There is not much involvement of other population groups, although the contribution of diverse communities like we have in South Africa can provide a rich diversity of thoughts and perspectives that are sometimes necessary to resolve complex research challenges. However there has been a great deal of optimism among the South African research community from the time when South Africa got its first democratically elected government. This optimism was matched by the reform in the country's education system which was expected to unleash a pool of talented students who were denied opportunities during apartheid. Although those working in higher education in South Africa have recognized that not many students graduating with Bachelor of Science degrees are enrolling for postgraduate degrees at Master's and Doctoral levels especially in the whole- organism biology. Part of the reason for this situation was identified to be the lack of emphasis on field biology (or research) in the undergraduate curriculum and the lack of understanding career options open to whole-organism biologists.

The Biodiversity Conservation Academy is designed to address such shortcomings. It provides undergraduate science students with skills required to tackle research problems, introduce them to current theoretical, practical, and philosophical issues in Biodiversity Conservation, and inspire them to consider science research as a career. Emphasis is placed on Biodiversity Science as this is an area of natural advantage for the country. The combination of our moderate climate and land ranges gives South Africa some of the world's most diverse animal and plant life (the laboratory in our back yard), and this means that South Africa has a potential to become a catalyst for scientific progression throughout Africa if we give priority to research areas where we have a natural advantage (e.g. Biodiversity Science).

This work demonstrates how the Biodiversity Conservation Academy mobilizes students from across South Africa into a biodiversity hotspot area in the Western Cape Province of the country to sensitize them to the importance of biodiversity and to issues of conservation and thereby contributing to building the new face of the scientific scholars not only in South Africa, but in the entire continent.

130. Promoting Science at School Level through hands-on Experiments

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Abstract. Over the last decade, it has been observed that there is a great decline in the interest of students in pursuing science across the country. After finishing their graduation in science, students tend to go for MCA/MBA instead of pursuing a career in science. The chief reason for this decline is that they don't get the required motivation/ drive due to the conventional manner in which the science is taught. The same is reflected in the India Science Report prepared by National Council of Applied Economic Research (NCAER).

As per the student's perspective:

1. Students don't find science education motivating
2. Equipment used is obsolete
3. The number of students in the class is too many to understand what is being taught in the class.

As per the teacher's perspective:

1. Inadequate practical training
2. It is a costly and difficult education with limited job opportunities

Therefore, there is a great need that students are exposed to various hands-on activities to develop interest in science starting at the school level itself. Recently, University Grants Commission (UGC) has sanctioned a research project "Investigating science hands-on to promote innovation and research at the undergraduate level" in which the undergraduate students are working on various sensors and data acquisition systems for carrying out experiments in Physics, Electronics, Biology, Chemistry and Biomedical Sciences. As part of the extension of the project, the experiments developed will be demonstrated at various schools. Therefore, students at the school level will be able to carry out various basic to advance level experiments through hands-on using various sensors like gas sensors, conductivity probes, pH probes, charge sensors, current sensors, light sensors, magnetic field sensors, drop counters, dissolved oxygen sensors etc. and data acquisition system LabQuest.

Therefore, it is envisaged that the above studies will be useful as under:

1. It improves students' understanding of various science concepts.
2. It provides free class time for student engagement in higher-order thinking skills such as analysis, synthesis and evaluation.
3. It encourages inquiry based laboratory activities.
4. It enables students to perform new experiments with measurements which were earlier not possible in the practical laboratories.

131. China Popularization of Science and Technology Infrastructure development and trends

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Abstract. In 2009, for the first time, China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China's PST infrastructure development status. Firstly, the author studied and established the overall evaluation index system for China's PST infrastructure development and six separate assessment index system for each category of PST infrastructure. Secondly, by using these evaluation index, Monitoring and evaluation on PST infrastructure was carried out and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status was obtained. At last, a series of further analysis on both successful case studies and reasons for major problems were conducted, and then the Author proposed several solutions on relevant issues. On The basis of this study, Report on Development of China PST infrastructures in 2009, as the first annual report, was completed and officially published. These results can not only lay a solid foundation for annual monitoring and evaluation of China's PST infrastructure project in future, but also provide policy making support for accelerating China's PST infrastructure construction. And the author believes this research will be a precious reference for other countries and regions in PST infrastructure development.

Keywords: Popularization of Science and technology (PST) Infrastructures, development status and trend, monitoring and evaluation, index system

Introductions

'The science and technology achievement can play fully use for social development, only if it was grasped and applied by the whole society'.[1] This statement is exactly a description of popularization of science and technology course itself. According to a society survey in US, formal education is the main pattern to build up people's science literacy [2] .People are bound to leave school sooner or later, while the development of science and technology is permanent, hence PST infrastructure provide an efficient platform for people's lifelong-study and promote science literacy. By the fully application of all sorts of PST infrastructure, the lay public can learn S&T knowledge, grasp S&T methodology, build up a Science belief and maintain Science faith, then enhance their own science literacy, and finally promote their capability on dealing with practical problem and participating in public issues. Moreover PST infrastructure founds an important base for PST work, being the key component in the entire public service system and construction of national PST capability. [3]

The popularization of new S&T achievement among the society and promotion of public science literacy are all depending on the national PST infrastructure's widely construction, fully application and sustained development. To get the overview of the development status in China then to provide policy-making consulting for PST infrastructure's sustained development on macro-level view,2009 China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China's PST infrastructure development status. Firstly, the research group established an evaluation index system for China's PST infrastructure development. Secondly, by using this evaluation index, the research group carried out a series of monitoring and evaluation work and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status, best-practice experience and shortcomings was finally obtained and relevant policy suggestions were brought out. On the basis of mentioned findings, CRISP complied and published a formal research report:"PST blue cover book•PST infrastructure development report in China of (2009)" [4].At last, by combinative analysis of 2009 and 2010 surveys, the author analysis the feature of each category of PST infrastructure development, summarize the main problems and predict the development trend of PST infrastructure development in near future.

PST Infrastructure Development Status in China

Currently definition for PST infrastructure in China

What is PST infrastructure? So far, there is neither a specificity research focusing on the definition in PST theory field, nor a university acknowledgement in both China and abroad on the content of PST infrastructure. The author is not to launch a discussion on the definition and content on PST infrastructure, but to extract main problems from Chinese PST infrastructure development presently on a practical view. According to"PST infrastructure development strategy, 2008-2010-2015," [3], the majority of PST categories in china is including: science museum, grass-root science facilities, online facilities and other popular science education venues (such as the popular science education base).

Science and Technology Museums are those museums that are main means for the public to carry out the main function of science education and display natural sciences and engineering sciences and agricultural sciences, medicine and science content mostly the museum. Including the Museum of Science and Technology (Science Centre), Natural Sciences Museum (Natural History Museum, Planetarium, Geological Museum, etc.), engineering (professional) S&T Museum and so on.

Online science facilities (Digital Science and Technology Museum): mainly refers to the use of modern information technology, integration, development of science-related network resources to the Internet as a platform for the public on the popular science education infrastructure. Those are including a number of science museums, science websites, science channel and other comprehensive sites.

Basic science facilities: the main means of counties (cities, districts) and towns (street) and village (community), and other science within the show, to carry out science activities science venues (by). This kind of science facilities are including the popular science activity stations (center or activity room), community school science, science parks, science bulletin boards (Science Gallery), science caravans and other facilities.

Others (PST education bases) : Relying mainly refers to the teaching, research, production and service institutions, which open for society and the public with specific science and technology education functions. Including cultural centers, Youth Palace and other cultural, educational venues; Zoo, Ocean Park, forest parks, nature reserves and other natural features with S&T education, history, tourism and other public places; research institutions and universities, laboratory, showroom or research centers, astronomical and Meteorological observatories, field observation stations; enterprises, rural and other production facilities open to the public (or processes), technology parks, exhibition halls, etc.; the other S&T education organizations or facilities which open to the public.

As one of the main science infrastructure in urban area,S&T museums are the cities' service center for S&T communication.S&T museums usually has relatively large scale, obtain ambulant science education resources and hold important positions among all sorts of PST infrastructures. As for the distribution of PST in China, PST infrastructure mainly locate on the grassroots level, these so called basic science facilities, with small construction scale and huge amount, played a "moisten things silently" role at the grassroots level for science popularization work. While online science facilities as a rising star, is developing rapidly, become the new force of PST infrastructure's construction and development. Other PST facilities (such as 'science popularization education base') are helping make full use of social resources of science facilities, play an important complementary and supporting role for PST construction and development.

Development status of PST infrastructure in China

Overall, PST infrastructure experiences a good momentum of development, undergoing a new wave of construction boom. According to recently survey, the PST infrastructure emerged as a rapid development trend on both form and scale aspect, with further expanding the scale of public participation.

Science and Technology Museum has become a more reasonable communication system, with scientists, engineers and the public stand on an equal exchange and communication platform. According to incomplete investigation by the research group, there are 582 Science and Technology Museums in China currently. Among them, there are 267 comprehensive S&T Museums, 122 industrial S&T Museums and 193 Museums of Natural Science. A diversity and wide range museum system has been formed, which is including Science and Technology Museums, Museum of Natural Science, Industry Science and Technology Museum (such as transportation museum, telecommunications museum, railways museum, geological museum and agricultural museum, etc.).

On national level, China now has one national comprehensive S&T museum, 33 Industrial Science & Technology Museums, 66 Museums of Natural Science. On provincial (ministry) level, there are 29 comprehensive Science and Technology Museums, while there are only three capital cities without a comprehensive Science and Technology Museum. There are 37 Industrial Science & Technology Museums and 53 Museums of Natural Science

53 on provincial level. As for prefectural (city) level, there are totally 128 comprehensive Science and Technology Museums, 30 Industrial Science & Technology Museums and 43 Museums of Natural Science. 109 Comprehensive Science and Technology Museums, 13 Industrial Science & Technology Museums and 23 Museum of Natural Science were built on county level.

According to the introduction of the "Science and Technology Museum building standards"[5], There are 9 especially large-scale comprehensive Science and Technology Museums, 18 large-scale integrated Science and Technology Museums, and 26 medium-scale comprehensive Science and Technology Museums. In 2009, there were about 30.2 million people visited permanent exhibitions, and about 670 million visitors visited temporary exhibition. However, there is still no comprehensive industry science museum in china and the gap between construction speed of Science and Technology Museums and pace of urbanization stays obvious.

Basic science facilities are divided into two major categories as fixed and mobile science facilities, which is constructed according to local conditions, flexible development and distributed throughout urban and rural areas. Fixed science facilities including the science activity stations (center or science activity room) located through streets, communities and towns, science schools, science parks, agricultural science service stations, science information stations, popular science bulletin boards (popular gallery) and so on. According to recently statistics, there are more than 270,000 science activity stations with the site area of more than 11 million square meters; 32 million science bulletin boards (Science Gallery), with a total length of over 2.1 million linear meters; over 2000 electronic bulletin boards science (Science Gallery), which can last more than one million hours. Current science facilities included science caravans, popular science show cars and other mobile facilities for science advocacy services. So far, the existing mobile science facilities in China include more than 1,400 vehicles and 270 science popularization caravans which are dispensed by CAST.

By the end of 2008 [6], there were totally of 1899 science popularization websites were built in China. According to the findings from a consecutive 3-months real-time monitoring conducted since March 2009 by Online Science Popularization Alliance, there were 600 online science popularization websites and 90% of them were running well [4]. Online science popularization concerns to more than 50 subjects, including mainly 5 fields as: natural sciences, agricultural sciences, medical sciences, engineering and technological sciences, humanities and social science. The founders of online science facilities are mainly composed by social organizations and Associations for Science and Technology on all levels. At the meantime, individual science popular websites got rapid development, science blog has become an interactively network for public participation in science and technology.

Science education bases in China mainly refers to the 'popular science education base' and 'youth science and technology education base', a 'pyramid' type framework has been formed among national, provincial, and municipal and county-level. There are more than 800 state-level science education bases, around 2,000 provincial science education bases, and more than 10,000 built on prefecture-level and county-level (without double counting, only the highest level of a complex statistical). The number of the popular science education base s in eastern part has accounted for more than half of the total number in the whole country, and the vast majority of the popular science education bases were built by high-tech enterprises, universities and research institutes.

Main Problems Facing the Development of China's Science Infrastructure

Although the PST infrastructure in China has achieved a good development, but at the same time, PST infrastructure development still can't meet the public demands on science and culture in the whole country.PST infrastructure's healthy development is faced with many problems and bottlenecks, such as funding, policy issues, human resource and science resources shortage. To sum up, all of those problems mainly located in the following two aspects.

Balanced development

At present, China PST infrastructure is not only faced the problem of insufficient volume, but also faced the problem of imbalanced development. Shortfall can be solved with the development ,while if imbalanced development cannot be controlled and get a overall planning, these problems will persist and may become worse, resulting in uneven distribution of resources and coursing waste.

Balanced development has two aspects: regional imbalances and imbalanced development inside PST infrastructure framework itself. Imbalanced development can be divided into a nationwide problem of regional imbalance development and an imbalanced development in local area. Imbalanced development across the country is mainly due to the impact from local economic development difference. PST infrastructure development of eastern part of China present significantly better than central and western region.

Almost half of the country's PST infrastructure was built in eastern region, for example, over half of S&T museums were built in eastern China, but in western provinces such as Tibet and Gansu even in their capital cities, there is not any comprehensive S&T museum so far. (Hainan didn't have as well).that do not have a comprehensive Science and Technology Museum (Hainan did not.) Imbalanced development within the local area is that within the administrative divisions at the provincial level, prefectural (city) and county levels, large, medium and small scale S&T museums should maintain a balanced portion with development. On the basis of "Science and Technology Museum building standards", there are some cities built several large-scale Science and Technology Museums. Among different provinces, areas with better economic development are better than areas poor economic situation, and urban areas are better than rural areas.

China Science and Technology Museum construction has been prominent imbalance. Data shows that there are more Museums about Science class, while pharmaceutical museums and agriculture related museums are less than normal. There are only 8 comprehensive National Museums of Natural Science , the 'true 'planetarium is only one, and so far there is not a comprehensive science industry museum in China can play an important role in the history of museum development in the world.

Sustainable development

Sustainable development for PST infrastructure is to concern about the problems occurred during the sustainable development of PST infrastructure, including policy, funding, human resources, PST, resources, operation strategies and management system. According to the result of investigations, almost the entire PST infrastructure is faced with a sustainable development issue.

S&T museums in China were mostly built in last century. Most of the S&T Museums in China cannot display their full effect. How to make these venues to re-revitalize and maintain sustainable development has already become a problem to carry out the work of the current science popularization problems. At the same time, Science and Technology Museums are built newly or under construction, by past experience (if you do not correct past practice), will soon follow up and face with the sustainable development issues. Among all these issues, the primary problem is the lack of fund, and then the problem of insufficient PST human resource, operation strategies, management system and public regulation also can impact the sustainable development of PST infrastructure.

Compared to museums of Science and Technology, the popular science education base, grassroots science facilities (including the science popularization caravans), online science facilities are all faced with the problem of sustainable development, and the problems are still pointing to fund, science human resources, operation strategies

,management system and regulation.

Because there is no associated financial and policy support, science education base are reluctantly or difficultly to carry out science popularization services, that cannot result in ideal effect. As for primary funding status for the operation of PST facilities, some sectors can barely maintain to carry out normal science fares, very few sector can guarantee the sustainable development of their PST facilities, which including training and supplement, exhibits designing, updating and maintenance and so on. Take western regions with poor economic situation for example, even the cost around 100,000 a year to maintain the PST caravans; it is still difficult for the science education base to guarantee. On most occasions, and it depends on the personal ability of managers to find ways to raise funds, as much as possible to carry out science activities.

PST infrastructure Development Trend in China

According to 'Popular Science Infrastructure Development Plan (2008-2010-2015)' and currently development trend, Chinese science development trend in the future of the infrastructure are as follows.

PST infrastructure construction continues growing, to reach a relatively rational layout for PST infrastructure in China as a whole The government should play a leading role in PST infrastructure construction, and an overall strategic plan on

national level need be strengthen.

First of all, the government is trying to build up a rational layout for S&T Museums in different region of China. In municipal region and some counties which already obtained necessary conditions, a number of S&T museums with specialized themes, topics, and other distinctive factors are encouraging to built by government; Some qualified research institutions, universities, enterprises and small towns ,which has vital resources or local priority conditions, were asked to construct a number of professional development (characteristics) or industrial technology museums; To take full advantage of major construction projects or idle enterprises belong to state and out of used production facilities, some industrial technology class museum will be constructed in future.

Secondly, the government will further promote Research institutions and universities open to the society to carry out science activities, promote Youth Palace, women and children activity center, parents-schools, culture palaces to add more science popularization content during daily service, encourage qualified enterprises to open their R & D departments production facilities (process) or Exhibition Hall to the public and to establish science sites; guide aquariums, safari parks, theme parks, nature reserves, forest parks, geological parks and zoological gardens to enhance their science education functions.

Thirdly, the government will promote the construction of county-level integrated science venues, which can provide PST education, training, exhibition and other PST service, across all of the country's counties (cities, districts) . Rooted in full use and integration of existing resources, the government have the plan to make more than 60% of the streets (township), communities (villages) can obtain a science activity stations (rooms), Popular Science Gallery (bulletin boards) will cover 60% of the communities and villages, and the S&T promotional content updating more than 10 times within a year; to increase popular caravan allotted number to 1,500 vehicles, and cover all of the prefectural (city, state) and the conditions of the counties (cities, districts); to press some qualified primary and secondary schools to built more conditions to establish Youth Science studio by use of existing education and training establishments .

The service performance of PST infrastructure infrastructures increased significantly and the opportunities for the public to promote their science literacy are of significantly increased as well

Full play the leading role of the government, from national level to strengthen the infrastructure of science to run the macro guidance. In accordance with "Science and Technology Museum building standards," do not have the development of education can not be fully functional or the role of science and Technology Museum renovation necessary; research infrastructure to develop science standards, identify measures, management regulations and monitoring and evaluation system, regularly carry out monitoring and evaluation, science by strengthening the infrastructure management to enhance overall service capabilities.

A substantive–development indemnify system of PST infrastructure was established

Relevant policies, regulations, fund, organizations and implementation, are all important guarantees to mobilize all social forces devoted into the development of PST infrastructure. Government should implement the state's relevant regulations and policies accompany with the further formulation PST institution system, improve the public PST infrastructure management system and operational mechanism to strengthen the operation management of PST infrastructure. The PST construction plan should be put into the national economy and social development overall plan accompany with the increase the portion of public input on PST facilities construction and operation fund. Put efforts to concretely carry out the existing tax incentives, to encourage enterprises, social groups and individuals get involved in PST infrastructure construction and operation management.

Conclusions

(1) Briefly introduction on currently main types of PST infrastructure in China and the definition for each type was given.

(2) A comprehensive and detailed analysis on development status of different sorts of PST infrastructure. According to data from recently survey, PST infrastructure has made significant achievements in China.

(3) Two subject matters are the balanced development and the sustainable development for PST infrastructure in China.

(4) Forecast for the development trend of PST infrastructure in China.

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132. ‘ H5N1– The Evolution of an Influenza Virus’ , A Study Into the Effects of an Exhibition and an On-Line Serious Game

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Abstract. Research question: Can an exhibition and an on line serious game contribute to knowledge and attitude with a general public about the threat of an avian influenza virus causing a human influenza pandemic? In an explorative study, the authors compare the effects of an exhibition and an on line game, by measuring knowledge and attitude of participants before and after visiting the exhibition or playing the game. People’s attitude toward animal experiment was also examined.

Introduction

On the occasion of the Darwin Year 2009 Erasmus MC, University Medical Center Rotterdam and the Natural History Museum Rotterdam organized the science manifestation ‘H5N1 – The evolution of an influenza virus’, which was about the continuous mutation of influenza viruses and the threat this causes for human health. The manifestation consisted of an exhibition in the museum and an on line serious game on the internet (www.thegreatflu.com), and lasted from February 11 until October 25, 2009. The manifestation targeted the general public and focused especially on pupils in the highest classes of secondary education (15 to 18 years old).

The manifestation opened on February 11, 2009. One month later the world was shocked by the emergence of the H1N1 Swine flu virus, which officially led to an influenza pandemic and dominated the news media for almost the rest of the year. This coincidence of the pandemic and the manifestation generated a lot of public and media attention for the exhibition as well as for the on line game. Especially the on line game was featured by news media worldwide, which in turn attracted unexpected high numbers of players. Up to date, more than 400,000 players from over 70 countries in the world have been playing the on line serious game. 17,500 people, mainly from The Netherlands, have visited the exhibition.

However, this coincidence also influenced the study both authors have been conducting into the effects of the exhibition and the game. On one hand the theme proved to be unexpectedly topical during the period in which the study was planned, resulting in an enormous amount of visitors. Thanks to this, more than 3,000 people completed the first questionnaire of the survey on the homepage of the game. On the other hand, news coverage on the pandemic appeared to be very similar to the content of the exhibition and game, which makes it hard to determine whether effects measured by the study were caused by the exhibition and game or by the attention given to the pandemic in the news media.

Methods

This study measured the effects of the exhibition and the on line serious game by conducting a questionnaire among visitors of the exhibition and players of the on line serious game, before and after their visit or game. The questionnaire consisted of 18 questions from demographics to biomedical knowledge, related to the subject of the manifestation, as well as attitude of the respondents towards science and related (ethical) questions, such as animal experimentation and vaccination.

Conclusions

New media applications, such as on line serious games, can attract new audiences but must be carefully targeted if specific target groups have to be reached. Both exhibition and on line serious game seem to have an effect on knowledge and attitude of participants, although the effects of the societal context should be taken into account. The attitude of the public towards science in general is both realistic and positive. The attitude towards methods of science and policy recommendations based on scientific research is critical.

133. Global and Local Knowledge Shown in Science and Technology Museum–Practice in China

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Abstract. After re-attracting world's attention by shining economic growth, Chinese curators in science and technology museum propose to reshape the image of China in historical river. Hence it is unavoidable to deal with the relationship between knowledge of localization and of globalization. The paper attempts to describe and analyze the practices in which the Chinese expressed their thought and sentiment in the science and technology museum.

Each of the localized knowledge of China is global knowledge network node, no matter in space or academic genealogy. Modern science and technology always looks alike globally, the traditional Chinese science and technology and their application all over China reflect the side of localization. In recent thirty years, science and technology museum in China become increasingly active in the formulation of the relationship between these two.

The paper presents multiple practices covered by 7 science and technology museums, including China Science and Technology Museum, Beijing Museum of Natural History, Beijing Museum of Traditional Chinese Medicine, Beijing Planetarium, Geological Museum of China, Shanxi Science and Technology Museum, Dongguan Science and Technology Museum, then summarizes several ways of combing globalized knowledge and localized knowledge together commonly used by Chinese curators, such as chronicle, communication, and Whiggish history. Furthermore the paper focuses on study a number of exhibitions and sections of science and technology museums in China with museology. It covers how to bring brilliant but controversial tradition of scientific and technological knowledge into global knowledge systems; China's division of work in global knowledge creation; how to express the tension between localization and globalization; how to avoid incommensurability between modern knowledge and non-formal knowledge; how to show the global influence of localized knowledge in science and technology museum properly, etc.

This paper summarizes the advantage and disadvantage when presenting localized knowledge and globalized knowledge in science and technology museum, and suggests related solutions including where to combine localized knowledge and globalised knowledge, how to combine and how to ensure the best effect of science communication.

Finally this paper gets the root cause why exhibition designer could not well handle the relationship between localization and globalization. The reason behind is the exhibition designer does not understand exactly the position of the object to be displayed in the coordinate system of science and humanities, neither for in the history of science. The topic of the localization vs. globalization actually is the reflection of the field of science and technology museum, which is raised by C. P. S now of 'The Two Cultures' problem: the split between scientific culture and literary/ humanistic culture.

134. Development of Interactive Science Communication Lecture for University Students

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Abstract. The interactive lecture was developed so that the university students may think about the relation between the science and the society. About 150 university students discussed, and expressed their own opinions about themes of genetically modified organism, a global environment, an up-to-date science technology, and bioethics, etc. It is important how science course students get social literacy and how researchers explain their research to the society. However, such a lecture was few up to now. Through this class, we can provide valuable chances to think about advantage/disadvantage of cutting-edge science.

135. A Study on Applying Knowledge Management to Improve the Effects of Communication of Science and Technology in Chinese Science Centers

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Abstract. The main factors that affect the effects of communication of science and technology in science centers include communication subjects, communication content, communication techniques, organizational publicity and audience quality. On the basis of introducing the meaning, role and actual application of knowledge management, this article demonstrates that through implementing knowledge management, Chinese science centers may raise the work capacity of exhibit designers and educational activity planners and organizers and the management level, organizational publicity level and audience service level of the science centers, thus improving the communication content and techniques of exhibits and educational activities, perfecting organizational publicity work and ultimately achieving the goal of improving the effects of communication of science and technology . In the end, this article discusses the key and difficulty of the science centers in successfully implementing knowledge management and suggests that the science centers implement knowledge management as early as possible so that science and technology communication is carried out in a better way.

Keywords: Knowledge management; Communication of science and technology; Chinese science centers;
Applied research

Foreword

In recent years, with the fast growth of Chinese economy and the high attention paid to science center undertakings by the governments at all levels, the construction of science centers develops rapidly in China. From 2000 to now, tens of science centers have been built up and opened and some science centers have been rebuilt or expanded. Particularly, under the vigorous support of the governments at all levels, the hardware facilities of the science centers are upgraded significantly and some science centers have reached international advanced level. For example, Guangdong Science Center completed and opened in September 2008 with a construction area of 138 thousand square meters is the largest science center so far in the world. For another example, the new premises museum of China Science and Technology Museum completed and opened in September 2009 has a construction area of 102 thousand square meters and Shanghai Science and Technology Museum completed and opened in December 2001 has a construction area of 98 thousand square meters. Under such good situation, how to further improve the effects of communication of science and technology and meet public demands on science popularization in a better way has become an urgent problem that the science centers need to think over and solve.

This article believes that drawing on the experience of domestic and foreign enterprises and public institutions in the implementation of knowledge management, the implementation of knowledge management in the science centers helps them improve the effects of communication of science and technology and fulfill their mission in a better way.

The Meaning and Role of Knowledge Management

The meaning of knowledge management

By implementation subject, knowledge management may be usually classified into organizational knowledge management and personal knowledge management. Organizational knowledge management regards knowledge as an important resource and raises the management efficiency, adaptability to changes and innovation ability of an organization through knowledge storage, acquisition, sharing, use and creation to ultimately realize the goal of enhancing the overall strength and competitiveness of the organization. According to knowledge management theory, knowledge includes explicit knowledge and tacit knowledge. Explicit knowledge is the knowledge which is expressed with words, numbers and voice, such as theses, monographs, research reports, product manuals, data, visual graphs and audio tapes. Tacit knowledge refers to the invisible and impalpable knowledge, such as secrets, insight, intuition, apperception, faith, ideal, value, emotion and mental model. Explicit knowledge may be transferred to other people easily, while tacit knowledge can hardly be expressed. While paying attention to the management of explicit knowledge, knowledge management pays more attention to making tacit knowledge explicit so as to realize knowledge sharing and creation.

The Difference and link between knowledge management and information management

Information management refers to an activity in which people comprehensively adopt technical, economic, policy, legal and cultural methods and means to control information flow for the purpose of raising information utilization efficiency and maximally realizing information utility value, whereas knowledge management not only includes the control and management of information flow but also realizes knowledge and information sharing and creation through establishment of a perfect sharing system and cultivation of sound organizational culture. The core of knowledge management is to share and create knowledge and make tacit knowledge explicit. Thus it can be seen, information management is only a part of knowledge management and can only realize management of static information resource and other explicit knowledge, while knowledge management gives more stress on realizing knowledge and information sharing, exchange and interaction, and the added value of static information resource through managing staff and inclusion of tacit knowledge which are usually neglected by people.

The role of knowledge management

Since the end of the 20th century, numerous enterprises have implemented knowledge management and achieved remarkable results. Some world famous enterprises, such as IBM, Siemens, Hewlett Packard, Xerox, McKinsey and 3M all have implemented knowledge management. Ikujiro Nonaka, a renowned scholar who studies knowledge management, thinks after in-depth research that the key to the extraordinary performance obtained by Canon, Honda, Panasonic, Toyota, Olympus and many other Japanese enterprises in stiff competition is their implementation of knowledge management.

The practice of these enterprises indicates that the implementation of knowledge management may produce the following effects:

1. Promoting information and knowledge exchange inside the organizations, avoiding repeated labor and raising work efficiency.
2. Realizing deposition and accumulation of organizational knowledge, upgrading personal knowledge to organizational knowledge and avoiding knowledge gap and organizational amnesia due to brain drain.
3. Advocating knowledge sharing and creation, encouraging mutual help and cooperation among staff and departments, enlarging the degree and scope of knowledge utilization and inspiring employee's creativity and initiative.
4. Making tacit knowledge explicit, enriching the capital of organizational knowledge and enhancing organizational core competence.

At present, more and more enterprises have implemented knowledge management and some public institutions also have implemented knowledge management. In view of the results of the practice of these enterprises and public institutions, it is also necessary for Chinese science centers to implement knowledge management in order to improve the effects of communication of science and technology. This will be illustrated below.

The Role of Knowledge Management in Improving the Effects of Communication of Science and Technology in the Science Centers

From the perspective of communication science, the main factors that affect the effects of communication of science and technology include communication subjects, communication content, communication techniques, organizational publicity and audience quality. The improvement of any of these factors may lead to improvement of communication effect. The science centers communicate science and technology mainly through audience's visit to them, so their exhibit design level and ability in organizing training and educational activities have a direct bearing on the effects of communication of science and technology. Besides, the management level, organizational publicity level and audience service level of the science centers all have a bearing on the effects of communication of science and technology. Through carrying out knowledge management, the science centers may not only raise the work capacity of exhibit designers and educational activity planners and organizers but also lift the management level and audience service level of the science centers, thus improving the communication content and techniques of exhibits and educational activities, making organizational publicity work better and ultimately realizing the goal of improving the effects of communication of science and technology. That is to say, the role of knowledge management in improving the effects of communication of science and technology is indirect.

Concretely speaking, the implementation of knowledge management in the science centers may produce the following effects:

Making employees pay attention to the importance of tacit knowledge and more attention to the communication of scientific spirits, thoughts and methods

From the perspective of knowledge management, scientific knowledge belongs to explicit knowledge, while scientific spirits, thoughts and methods belong to tacit knowledge. As described above, the communication of explicit knowledge is easy, but the communication of tacit knowledge is difficult. No doubt it is important for audience to accept scientific knowledge when they visit the science centers, but it is more important for them to learn scientific spirits, thoughts and methods. Therefore, during design of exhibits and organization of educational activities, the science centers should always bear in mind how to improve audience in scientific spirits, thoughts and methods after they visit exhibits and attend educational activities.

Raising the work capacity of exhibit designers and educational activity planners and organizers

The level of exhibit designers directly decides the level of exhibits, while exhibits are the foundation of the science centers, so it is vitally important to raise the work capacity of exhibit designers. Meanwhile, as informal educational institutions, the science centers also assume an important task of education. The educational activities provided by them include exhibit / exhibition explanation, scientific shows, laboratory courses and popular science dramas. Effective educational activities can’t do without careful plan and nice arrangement, so it is very important to raise the work capacity of the staff responsible for educational activities.

Exhibit designers and educational activity planners and organizers may improve their expertise through self-study, advanced studies, learning from experienced persons and attendance of seminars. In this process, they should study hard, comprehend tacit knowledge, convert it into their own knowledge and make it explicit if possible. Through implementing knowledge management, exhibit design department and educational activity management department may help their employees know explicit knowledge and tacit knowledge in a better way, make tacit knowledge explicit, fulfill knowledge sharing and creation, effectively improve employee’s work capacity and teamwork spirit and finally design high-level exhibits and develop high-level educational activities. Making tacit knowledge explicit plays a significant role. The example below is enlightening.

In 1985, when Panasonic researched and developed a new type of household toaster, the bread was burnt outside and unbaked inside every time. The R&D personnel racked their brains for a solution in vain. In Osaka, Osaka International Hotel was known far and wide for its delicious bread. In desperation, the company assigned Ikuko Tanaka
– a software R&D staff to learn “kneading” technique from a bread chef of the hotel. Gradually, Ikuko Tanaka found that the chef’s kneading technique was unique. After one years’ effort, Ikuko Tanaka closely cooperated with project engineers and finally proposed modification to the structure and performance of the machine, including addition of special rib-shaped convex grains on the inner wall of the machine, thus successfully reproducing the kneading technique she learnt in the hotel. This created Panasonic’s unique “fried dough twist” technique. This product set a new sales record of new-type cooking utensils in one year since it was put on the market. The R&D of the toaster succeeded in the end because the R&D personnel dug out the tacit knowledge that even bread cooks couldn’t explain clearly, and applied it properly.1

In actual work, perhaps the employees of the science centers may solve problems only after numerous setbacks and innumerable hardships. When we share our knowledge and experience with others, it benefits both others and ourselves. In reality, we often think that we know a thing, but when we try to speak it out or express it with language, we find it is very difficult for us to speak it in a systematic and complete manner and make others understand it, mainly because our understanding on this knowledge point is not as proficient as we think. In this case, we should learn and study this knowledge point more deeply. After longer communications with others and more extensive reading and discussion, we may become proficient gradually. Therefore, we shouldn’t rest content with the degree of thinking we know and should do some conscious work to make it explicit and should consciously make others understand the principles we know. If we form this habit, it will prompt us to more deeply probe into the roots of problems and raise the level of our understanding on knowledge. If we develop a habit of consciously making our knowledge explicit, we will find our understanding on problems is getting deeper, thus getting rid of the state of a smattering of knowledge and raising our ability.2 On the other hand, as long as we carefully think over other people’s experience and lessons, we may learn a lot from them.

Digging audience demands through management of audience knowledge

In order to improve their work and meet audience's demands in a better way, many science centers collect and analyze audience information and know their comments and demands on the science centers by means of audience message, questionnaire and seminar. Regretfully, some science centers don't carefully study the collected audience information and fail to discover some audience's potential demands. In this aspect, Wal-Mart's "story of beer and diaper" provides much food for thought.

During shopping basket analysis on customer' shopping behavior, Wal-Mart discovered unexpectedly that the commodity bought most together with diaper is beer. For this reason, Wal-Mart investigated and analyzed this result. A plenty of actual investigation and analysis revealed a consumption tendency of Americans behind "beer and diaper": American wives often ask their husbands to buy diapers for their babies after work, some young fathers will buy baby diapers in supermarket after work and 30%~40% of them will buy some beer for themselves in the same time. Since the chances of sale will increase when diapers and beer are put together, Wal-Mart places diapers and beer together in each of its outlets. Consequently, the sales of diapers and beer rose significantly.

After reading this example, we should ponder over: does our investigation indeed dig out audience's demands? Do we initiatively share the information we dig out with other departments? The answers may not be satisfying. This requires the science centers to truly dig out audience's demands through implementing knowledge management so as to design exhibits, carry out educational activities and meet audience's demands in a better way.

The Key and Difficulty to Successful Implementation of Knowledge Management in the Science Centers

According to the practice of numerous domestic and foreign enterprises and public institutions, the key and difficulty to successful implementation of knowledge management rest with human factor and active participation of all staff, not the establishment of a knowledge management software system. To generate a good effect from the implementation of knowledge management, the science centers must solve the following critical problems:3

Correct and comprehensive understanding of the connotation of knowledge management

Without correct understanding on knowledge management, inevitably the outcome may be in the opposite direction during the implementation of knowledge management. Some people think knowledge management is information management, knowledge management can be bought through purchasing of technology and software, and the establishment of a knowledge management software system means the completion of knowledge management. This understanding is one-sided. Knowledge management is system engineering and not only contains all content of information management but also pays more attention to managing staff and relates to organizational culture, organizational structure and operating mechanism. Therefore, in no case can a set of knowledge management software solve fundamental problems. The core factor of knowledge management is human.

Leaders' long-term support

In the process of implementation of knowledge management, the greatest resistance perhaps comes from the managers or employees who don't like or are reluctant to adapt to new work environment. In the face of various resistances, firstly the leaders of the centers ought to overcome themselves in concept, change their concept and give support to the implementation of knowledge management from the aspects of human resource, material resource, capital and time. Then, they should participate in the implementation of knowledge management, convince employees with sufficient reasons and their personal experience that knowledge management indeed will bring benefit for the science centers.

Each science center should establish a knowledge management team and appoint a knowledge supervisor assumed by one leader of the center who is responsible for this work. Only when one leader of the center assumes the position of knowledge supervisor can the goal of knowledge management cooperate with the goal of the science center. According to the experience of other organizations, if the work on implementation of knowledge management is handed over to grass-roots technicians or there is no knowledge supervisor, the due effect that should be achieved from the implementation of knowledge management would become impossible. Knowledge management is long-term work and needs persistent support from the leaders of the center in order to achieve a satisfying effect. Besides, during implementation of knowledge management, middle-ranking cadres serve as a bridge linking center leaders and grass- roots staff, their own departments and other departments, and their knowledge sharing behavior is very important, too4.

Active participation of all staff

Only with the support of the leaders of a science center and without active participation of grass-roots employees, can hardly the science center achieve a good effect from the implementation of knowledge management. What is the most critical and also the most difficult in the implementation of knowledge management is to share and create knowledge and make tacit knowledge explicit. As knowledge is exogenous and employees have a competitive relation, considering their own interest, employees are reluctant to transfer their knowledge or have some reservation during the transfer of knowledge. Therefore, the science centers should formulate an evaluation method and an effective incentive mechanism for knowledge sharing, take various measures to form an organizational culture good for knowledge sharing, reasonably evaluate and reward employees based on the knowledge contributed by them in order to stimulate employees' enthusiasm and make them spare no effort to contribute their own knowledge (tacit knowledge in particular) in a good atmosphere of mutual trust and mutual respect, thus reducing the management cost of the science centers, raising the operating efficiency of the science centers and realizing the goal of improving the effects of communication of science and technology of the science centers while raising the quality of each employee.

Conclusion

It is foreseeable that the implementation of knowledge management may further boost the strength and undertakings of the science centers. Under the background that the research on knowledge management theory is going deeper and practical application is getting wider, Chinese science centers should implement knowledge management in the earliest possible time so as to elevate exhibit design level, educational activity level, management level, organizational publicity level and audience service level as soon as possible and communicate science and technology in a better way.

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136. A General Research about the Role of Science Center and Science Museum—From the Perspective of Dealing with the Global-Warming Problem

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Abstract. As we all know, climate-warming has become an indisputable fact, and this world-wide problem brings a series of serious results, such as climate change, the rising of sea-level and acceleration of glacier-melting, endless natural disasters and so on, which pose a serious survival challenge to all living things, including human beings. Climate-warming is a global problem, and it is the common challenge facing the people of the whole world. We have to attach a great importance to this problem. This paper argues that, to deal with global climate-warming, all the countries in the world need to act together. As for each individual, the most important point is to develop a low-carbon lifestyle, which was advocated during the Climate Change Conference in Copenhagen in 2009. Then, as the main place for people to get knowledge and attitudes about science and experience scientific research, what role should modern science center and science museum play in dealing with this crucial and urgent global climate-warming? This paper argues that, based on the above question, The modern science center and science museum should pay much more attention to help people understand and learn how to deal with climate-warming, not only just focus on the popularization of the knowledge of science and technology, scientific and technological achievements, and providing places for people to play interesting experimental games. Modern science centers and science museums should establish a special area to highlight climate-warming problem, where people have access to know the origin of climate-warming and what challenges it has posed to the whole world. These centers and museums help people realize the importance and the urgency for all countries to deal with climate-warming problem, as also show people the achievements which have been made in recent decades, it also introduces the main practices adopted by all countries in the world. The most important point is to help people get knowledge about how to deal with climate-warming in everyday life, introducing the subject of low-carbon to the people, advocating low-carbon lifestyle, help people develop low-carbon living habits in every detail of daily life and make contributions to lessen the problems due to climate-warming.

137. Science Center as Tool for Communicating Science in India–A Review

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Abstract. This study highlights the impact of science and technology centre via., museums, zoos, aquaria and science centre in India to promote science knowledge among the public. There is significant evidence that interactive science exhibitions increase visitors' knowledge and understanding of science. The Science & Technology centre have provided memorable learning experiences which can have a lasting impact on attitudes and behaviour of the visitor. Further, this centre has wide-ranging personal and social impacts and promotes inter-generational learning and promotes trust and understanding between the public and the scientific community. The economic impact of centre is also felt in this review. The difference between a science museum and a science centre is like a line drawn in water is also felt in this study. There is a very substantial body of evidence for learning occurring has been understood mostly from studies of families using interactive exhibits in centre. It is also highlighted in the review that Centre elicits powerful emotions, which help create memorable learning experiences as well as wide-ranging personal and social impacts. There is significant evidence observed in the study that Centre provide lasting benefits. Learning that occurs today depends on yesterday's learning and is the foundation for tomorrow's learning – concept is underlined in the centre objective.

Keywords: Science centre, Interactive learning, Impact

138. Gujarat Science City: Cultivating Scientific Creativity in the Community

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Abstract. The Gujarat Science City (GSC), working under the aegis of the Department of Science & Technology, Government of Gujarat, is emerging as an effective and large scale science education and popularization platform in the country to promote innovative and experimental activities through hands-on activities and minds-on exposures.

GSC adopts the approach and methodology of informal community based learning that is different from the formal mode of education. All of its programs and activities are intended to enliven the imagination, foster creativity and develop a spirit of inquiry, especially in young minds. Schoolchildren, during their visit, are discovering the wonders of science and technology and get an access to the most exciting and contemporary form of entertainment regardless of the social stratum, education or age group and create a culture of learning.

GSC extends the earlier models for science museums and science centers by integrating key characteristics from theme parks, retail, and theater to create a new form of educational attraction called edutainment, i.e., education through entertainment.

GSC plays an effective role as a vanguard for the dissemination of the latest science information for understanding our world, raising public awareness of current research and stimulating an interest in science among young students and community members. The content is focused on the programmes, activities, galleries, displays, exhibits, methods, means, strategies etc to attract and inculcate scientific temper among the students as well as visitors. The creative, enthusiastic and entrepreneurial approach in each of the programmes of GSC is effective and relevant, meeting the pedagogy of science teaching and learning. We shape minds and meaningfully connect our communities to the world around us, reaching students, teachers and families with the fascination and promise of careers in the sciences.

The trend is up beat and the Gujarat Science City is now acclaimed as a must see destination for at least 15,00,000 visitors annually, where science is a fun. The place is being recognized as a must see Science Tourism destination for respecting science and creating future scientists of the country.

The paper describes the innovative approach of GSC in designing the tools and techniques for public understanding of science along with cultivating scientific creativity in the community to capture new heights in science literacy in support of effective decision making.

139. What is Science Museum? –Case Studies on Chinese Science and Technology Museum

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Abstract. As an important science communication pattern, what is the role of science museum is a question worth considering. This paper, taking the development of Chinese Science and Technology Museum (CSTM) as case studies, researches the role of science museum from the science communication aspect.

Firstly, science museum is a science teller. It tells the public what is science and technology. From exhibits to experiences, the initial purpose of CSTM is to let public know the specific science knowledge. However, science communication is to explain the scientific meaning and the beauty of science, rather than to emphasize the important position of science. Therefore, the purpose of science communication is to help the public and the scientific community for science& technology-related matters between the make correct judgments and decisions. As a result, science museum should be as a tutor of science literary. This is the second role of science museum. It should be noted that science literary not only contains specific knowledge, but should be elevated to a level of critical spirit and scientific habits of thinking levels. Thirdly, science museum should be a science discussant. As science and technology is a double-edged sword, science museum should not only provide public the useful side of science, while abandoning the discussion of the hazards of science. How to provide such platform among public, scientists and scientific community, should be an important discussion point for science museums' further development. At last, science museum should be as a science leader. In the modern time, both developed and developing countries, promoted scientific human resources as a strategic resource to enhance core elements of national competitiveness, vigorously strengthen scientific and technological human resources capacity building. Endless train a large number of high-quality vibrant and innovative talents, directly related to the country's future. As an enduring vitality, fixed place of science communication, science museum has inherent advantages of scientific human resources training. In the further development, science museum should paid more attention to select scientific talents, stimulate young people's intrinsic interest in science, cultivate the courage and firm determination in the continued science practices.

140. IEC: A Study From the Science Communication Prespective

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Abstract. Information, Education and Communication (IEC) is dealing with bridging the digital divide, gender divide and knowledge divide using different communication tools at different levels. This paper specially focuses on Village Resource Centres (VRCs) and Village Knowledge Centres (VKCs). VRCs and VKCs mainly provide need-based locale-specific, demand driven information content (both dynamic and static) based on collection of several secondary data and a well-planned need assessment, organizing training and awareness programmes and making linkages with several leading institutions / organizations for translating the content into field-based applications.

The study also specially refers to “Mission 2007: Every Village a Knowledge Centre” by MSSRF. The purpose of the movement is to know how we will take ICT-enabled development activities to all over India particularly in the rural areas as a consortium mode. Since then every one of this network members will meet and discuss many issues related to content, capacity building, care and management, connectivity, financial sustainability, etc. The mission is referred to as ‘Grameen Gyan Abhiyan – Rural Knowledge Movement” since August 2007.

Under the CD-ROM library this programme provides necessary research inputs to researchers in the area of agriculture. The Hindu Media Resource Centre of the MSSRF is organizing several theme-based media interactions, organizing millennium lectures, etc. in different facets of sustainable development.

141. Augmenting and Sustaining Informal Science Education: A Project for Professional Development and Community Building for Informal Science Educators

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Abstract. When critical issues arise such as climate change and energy transitions, when natural disasters occur (e.g., hurricanes, earthquakes, floods, drought, etc.), or when local populations are asked to make important decisions regarding Earth science issues (e.g., drilling for oil or gas, clear-cutting forests, building dams, etc.) local populations needs credible scientific information on these subjects in a timely manner. Most people get their information about Earth science issues from informal sources (outside of formal—kindergarten through college—education). A decade ago that meant that most of the public got their information about science from informal venues: science centers, museums, zoos, parks, aquaria, etc. Today, however, informal sources of information also include Facebook, Google, Wikipedia, and other websites and media. Although there are some media and online resources that do disseminate credible science research, many do not reflect accurate scientific information, and the struggle to get credible information to the public has greatly increased.

There are thousands of informal science venues across the globe – many in rural areas serving groups underrepresented in the sciences. These venues can be excellent sources for dissemination of credible, timely science information to the public. The fact that an estimated 150 million people in the U.S. visit the more than 400 U.S member museums of the Association of Science-Technology Centers every year (www.astc.org) and that in total American museums average over 865 million visits per year (www.aam-us.org) reflect incredible opportunities within these venues to educate the public about Earth science. Most Americans have never taken a geoscience course; yet in the informal setting of a museum, learning can occur among audiences of all ages and backgrounds. Unlike formal education settings, the open-environment, collections, exhibits and resources that informal science venues provide allow for a more visitor-directed learning experience, allowing visitors to ask questions and discover at their own pace—an "inquiry-based" environment. This can lead to enriched lives, Earth stewardship, and public understanding of Earth science research. Many scientists can trace their first motivation to pursue a career in science from such informal experiences as visiting a museum.

To assess the current state of informal Earth science education, the Paleontological Research Institution (PRI) conducted a U.S. National Science Foundation (NSF) funded study to survey museums and science centers throughout the United States—a sampling of the informal Earth science community that offer at least some Earth science education and/or exhibits. The survey was mailed to over 300 institutions, and was filled out and returned by individuals from

75 organizations. We believe that the museums that responded to our survey are fairly representative of the whole sample, and any bias would likely, if anything, over estimate the amount of Earth science available in museums since organizations with little Earth science exhibits and programming would most likely not have replied to the survey. Most museums in our sample are less than 10,000 sq meters (median of 1,900 sq meters) with a median number of

44 full time staff equivalent. The median number of staff per organization involved with education and exhibits who have geoscience training (degreed in Earth or geo-science) is only one (1), and about 1/3 of institutions have no Earth science trained staff. The lack of qualified, Earth science educated staff in informal science institutions underscores the need for quality professional development for these educators.

To give staff working at these informal science venues an opportunity to enhance their Earth science knowledge and to develop inquiry-based programs, in 2007 PRI partnered with the Institute for Global Environmental Strategies and the Earth System Science Education Alliance (ESSEA) to develop and pilot a 10-¬week, one-¬credit graduate-¬level course for informal educators, called "Global Climate Change and Informal Earth System Science." In this course, the participants review the basics of Earth system science and how to gather and disseminate credible information on climate change in a module entitled "Global Climate Change." Next, the students put this knowledge into practice by expanding upon existing collections, exhibits, and/or programming at their venue in a second module, "Earth System Science in Your Backyard". The course culminates with participants creating a "Virtual Fieldwork Experience", in which they focus on a local site and create an inquiry-based exhibit or program from an Earth science perspective that is relevant to their local population. The course is asynchronous and entirely online; content and resources for the course are all online, and a website was developed by Dr. Buckler for forums and discussion groups. Students complete

weekly assignments, working both in teams and as individuals. Graduate credit for the course is offered through State University of New York, Oneonta, (SUNY) and Dr. Buckler (Adj Asst. Professor, Earth Sciences Department at SUNY) is available online for participants, and gives regular feedback to facilitate participants' learning.

The response for the course has been overwhelming; for three consecutive years, 60 – 100 registration requests were received for the 10-participant class. Since the course is online and asynchronous, both geographic and time zone restrictions are transcended, thereby permitting a truly global community. During the three year pilot of the course we have been fortunate to have several participants working in territories and countries outside the U.S., including: in 2007, from Modena University, Modena, Italy; in 2008 from the Caritas Natural Preserve in Puerto Rico; and in 2009, a Cornell University graduate student working in the Bandipur National Park, Bangalore, India. After taking the course, V. Padovani, form Modena University, came to the U.S. for a 3-month internship at PRI to study how public science exhibits and programming are produced in the U.S. Dr. Buckler was then asked to be a PhD advisor to V. Padovani, and PRI has also since collaborated with and loaned a number of specimens from its collections to Modena University for study and use in outreach exhibits to the public. The experience of international cooperation and sharing of resources between participants and their venues has persisted to the present.

To continue providing quality informal science professional development and further build a global informal science education community, PRI is now seeking funding from NSF and the National Oceanic and Atmospheric Administration (NOAA) to expand and refine the current course. Based on three years of experience and evaluation, the course offerings would include:

- a module on incorporating evaluation into public outreach programming and exhibits,
- bridging the gap between informal and formal educators by learning to establish collaborations between informal educators and their local schools and teachers, and
- establishing a database of program and exhibit resources created by participants that can be used by other informal–and formal–science educators from around the world.

Under the current project, for international non-credit students, tuition for the informal educator professional development course is waived; access to all resources is universal to all participants, and past participants are strongly encouraged to act as mentors for incoming students.

The primary goals of this course are:

- to offer quality professional development in Earth science so that participants can create their own, in-house, inquiry-based, relevant programming for their local audiences;
- to establish a core set of resources for informal educators to communicate science to the public; and
- to create global community among informal science educators, to enhance communication and share resources and ideas.

In this process, the value of an international exchange of resources and ideas among informal science venues from around the globe cannot be understated—especially given the need for global cooperation in addressing issues such as climate change, disaster preparedness, and natural resource preservation. Although many of the science issues and concerns facing populations around the world are unique, there are commonalities among effective methods by which informal science venues communicate reliable scientific information to the public.

In addition to offering this course, for the past decade PRI and its Museum of the Earth have also demonstrated its success in working with researchers at Cornell University and across the U.S. and in Europe to create exhibits and programming outreach for the public. Exhibits have included, "Marine Life versus the Gulf Oil Spill: Under Siege", "Darwin: Modena and 200 years of Evolution", "The Global Climate Change Project", "The Green River Formation", and "Exploring the Evolution of Biodiversity". Currently, PRI is actively seeking to expand upon its current associations with informal science educators in Italy, Germany and Japan to include collaborators from across the globe.

142. Climate Change Induced Coastal Disasters and Mass Media

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Abstract. Time immemorial the humanity is faced with natural disasters. For many centuries people believed that the disasters are destiny or ordained which cannot be erased. Hence they faced the disaster and waited for the next to come. Now the scientific inventions have made us understand that the unending disasters are the causes of irresponsible behavior of mankind.

Disaster is one of the greatest challenges being faced by the mankind and thus Disaster management has become a prominent area of science communication. It is gaining in importance in the public sphere with NGOs, scientists, journalists, and policy makers in particular taking a pro-active stand. Sea level rise, cyclones, and floods devastate coastal low-laying areas. Such events triggered and/or aggravated by climate change affect millions of people in the developing countries the most.

India has been identified as one among 27 countries which are most vulnerable to the impacts of global warming related accelerated sea level rise (UNEP, 1989). The high degree of vulnerability of Indian coasts can be mainly attributed to extensive low-lying coastal area, high population density, frequent occurrence of cyclones and storms, high rate of coastal environmental degradation on account of pollution and non-sustainable development. Most of the people who are below poverty line are living in the low lying areas and are directly dependent on natural resources of coastal ecosystems who are highly vulnerable to any global warming-induced climatic change.

The role of media, both print and electronic, in informing the people and the authorities during emergencies thus, becomes critical, especially the ways in which the media can play a vital role in public awareness and preparedness through educating the public about disasters; warning of hazards; gathering and transmitting information about affected areas; alerting government officials, helping relief organizations and the public towards specific needs; and even in facilitating discussions about disaster preparedness and response.

There is a need to find out the effectiveness of the media in creating awareness, handling the disaster mitigations, its effects on the coastal areas and its short falls in meeting the social obligation; it is expected to perform to overcome the challenges it poses to the humankind. Whether the media has devoted its attention to coastal disasters? The study examines. Creating awareness during ordinary days is most important than the coverage during disasters to reduce the risk of a disaster, as disasters cannot be prevented. Keeping in view of the broad objective on the role of media in disaster management in public safety and emergency, whether the level of awareness created by the media is sufficient?

The methodology is based on content analysis of the media text to show the process of coverage of coastal disaster in terms of creating awareness, by analyzing the media content in the past one year in the popular English magazines like India Today, Outlook, The Week and Front line.

In this research it was found that articles were covered by the magazines as an event and not as a process that examines the causes in-depth. The contents on disaster awareness were very meager, less proactive contents were found, most of the media focuses attention on the death toll, not caring about the relief measures. The media has not proposed an alternative plan for the rescue operation. The media should act as a positive force. Positive news coverage can reduce terror and give some psychological relief to the affected community.

143. Adaptations for Climate Change and Coastal Disasters Using Information and Communication Technology

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Abstract. Information and Communication Technology application of village Information Centres are computer-based information network set up in villages to supply locally-needed information and to empower the villagers. They are called by different names: tele-centres; village information centres; village resource centres and their subunits village knowledge centres; and information kiosks. They are particularly effective in 1000-odd km coastline of Tamil Nadu and Pondicherry prone to disasters and are widely acclaimed as successful ICT ventures.

Such village knowledge centres and village resource centres (VKC) initiatives of the MS Swaminathan Research Foundation (MSSRF), Chennai, Pondicherry Multipurpose Social Service Society, Pondicherry, DHAN foundation Madurai, Sathiyabhama university in kaniyakumari and Nagargoil coastal districts are an effort to present workable models of providing information and communication technology (ICT) for development. Villagers in a fishing village are keen to get accurate forecasts of wave heights and location of fish shoals. The women need more information on health-related issues from women doctors. That is why it is important to provide timely locale-specific information. The information provided should be authentic and useful in the specific context. Staff of village knowledge centres work closely with partner organizations such as government hospitals, health organizations, judicial courts, agricultural universities, research laboratories and field stations and marketing organizations.

ICTs are tried out to bridge gender, social, economic and technological divides. The resource centre is at the core of the ICT for rural development movement. Particularly under the circumstances of climate change when temperature rises, crops fail and fish yield decreases, people indulging in these as primary occupations are left with less money, and any sort of support including that promoting good health is really a great relief.

The paper would examine the challenges and opportunities, potentials and pitfalls of using ICTs for tackling climate change, particularly in coastal areas which are more sensitive towards climate change. The study would specifically focus on village resource centres and explore their role and relevance for creating climate change awareness. The prime objective of the study is to study the effectiveness of Information and Communication Technologies particularly village resource centres (VRCs) in creating climate change awareness particularly in coastal areas.

Some village knowledge centres and village resource centres along coastal areas have been studied. The reason for targeting socio-economic backward coastal communities is that they have not taken environmental and climate change lessons and honing the skills of the people in this coastal area will have great social impact. Although educational level may be low, environment awareness is increasing in the coastal areas as coastal environment is fragile and prone to several hazards such as cyclones and the resultant storm surges, and the coastal communities have an urge to protect ecology.

144. Communicating About Space: The Final Frontier?

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Abstract. Late 2006 Belgium joined an educational pilot project of the European Space Agency. The purpose of the project was to set up a space education resource center in the countries participating in the pilot program. An explorative research towards the needs of the Belgian education landscape concerning space and astronomy, gave ESERO Belgium the knowledge needed to start up the project. Space is regarded as something fascinating, therefore it is an excellent subject to make children familiar with science and technology. A lot of teachers feel the same way but the research showed that teachers (or other educators) are often scared of communicating about space. They feel insecure about their knowledge of the subject and thus try to avoid communicating about this subject or do so in a not very exciting nor interactive way. This is where ESERO steps in. Not only does ESERO provide high quality educational material (about space and astronomy) for teachers, youth organizations, etc to use, the project manager also organizes workshops for them to explain how to make optimal use of the material and to help them in their communication about the subject.

Almost three years later ESERO Belgium has booked some big and small successes. We have organized major events about space (with astronauts present at the events), to introduce the theme “space” and also astronomy to kids and youngsters of various age groups. We have developed teaching material, and are still developing more teaching aids. We are providing workshops regarding communicating about space for teachers, educators and most importantly student-teachers. The student-teachers are a very important target group, they are the new generation of educators who need to stimulate and get our children enthusiastic about science and technology. ESERO Belgium would like to introduce the project in a parallel session at the PCST conference. ESERO is regarded a best practice case for communicating about space. We have build up some extensive experience concerning the do’s and don’ts in teaching the teachers communicate about space and space-related subjects. ESERO Belgium is located at the Planetarium in Brussels.

145. Role of Museums in Science Communication with Special Reference to Nehru Science Centre, Mumbai

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Abstract. Science is an unbiased body of knowledge that urges people to be questioning, reflective and critical. It is also a social endeavour pursued by scientists who are part of the existing socio cultural milieu. The question then arises whether the society is equipped to cope up with the rapid advances in science. Science has the potential to be either beneficial or harmful. Despite professing an apparently positive outlook towards science, there is in general very little awareness or understanding among the public of how advances in science and technology affect our daily lives. Many a times it also the public which bears the brunt of the bizarre consequences of science misapplied. So the public has to be infused with scientific knowledge as well as be empowered with the capacity to weigh the pros and cons and make prudent judgment. This conviction forms the rationale for communicating science.

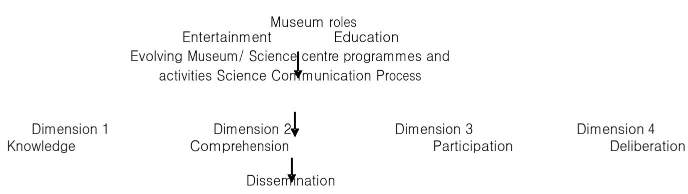
Scientific knowledge is complex and so communicating science is not easy. In a modern democratic society, each citizen should be able to discuss knowledgeably the scientific issues affecting their lives and make correct decisions regarding them. This brings into fore the importance of science communication and the agencies capable of doing this. Science communication is the process of conveying simplified scientific information to the public using various means and media, and unarguably science museums/centres are the fore runners in this job.

A visit to any museum/science centre full of colourful and visually attractive gallery exhibits is always entertaining and overawing. But it also raises several questions. What is the mission of the museum//science centre? Is entertainment it's only purpose or is it something more? Does it just display artifacts or go beyond exhibits to communicate science?

As public institutions in the socio-cultural milieu, museums/science centres any where in the world profess to perform the three roles of Entertainment, Education and Evolving through the variety of programmes that they offer to the public. And one such museum in Mumbai metropolis is Nehru Science Centre, touted as the one of the largest science centre for the youngest citizens and attracting lakhs of visitors annually. With this in view the researcher has attempted to study the role of museums in Science Communication with special reference to the programmes conducted by Nehru Science Centre, Mumbai, for the period 1986-2006.

Using the case study method with some amount of quantification of data for the purpose of analysis, the researcher has profiled the growth of Nehru Science Centre during the period 1986-2006 and has described the various activities of the centre in terms of its roles and related them to the identified dimensions of science communication through the model of science communication developed by the researcher. The model views the museum as an informal learning setting, influenced by the relevant theories of learning and communication, and performing the three roles of Entertainment, Education and Evolving through the variety of programmes and also communicating science.

The process of science communication has been envisaged as having four dimensions which are assumed to be static and hierarchical.



In order to facilitate analysis the researcher has also developed an arbitrary Science Communication Index.

The study concludes that Nehru Science Centre has grown over the two decades both in quantity and quality of the programmes and activities. All the programmes are aimed at entertaining and educating the public, underpinning the center's commitment to these roles. The Centre is found wanting in the areas of research and staff development. Also in the process of science communication there is an evidential shift from mere dissemination of knowledge to more of participation. So if better emphasis is given for research and staff development, if programmes involving the public like citizen panels, public debates on health related issues are held, perhaps the days are not far off when Nehru Science Centre will reach the deliberation mode, which is the ultimate goal of science communication.

146. Dual Identifications of Science Centre: Research and Practice in China

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Abstract. Science centres in China nowadays are generally facing great pressure in sustainable development. Most reasons of this dilemma are the differences between the special dual identifications of the science centre: the role of the public welfare purposes in the science centre identified by the government, the need of the market player role identified by the science centre itself. The possible solution is to give the science centre a normal identification, the marketing player identification generally owned by the international science centres.

Keywords: Science centre, Identification, China

In China, a government-led catch-up modernization country, the cause of science centre starts from zero and grows rapidly to be a vigorously new member in the international community of science centre s in 22 years[1] . Its development experience is worthy studying by other countries, especially by the developing countries.

Since its establishment in 1988, the cause of the science centre in China has made remarkable development. All kinds of science centres reach 200 and attract 40 million visitors each year, making a great contribution to the dissemination and popularization of science and technology. However, most science centres in China nowadays are facing great pressure in sustainable development and survival. Most reasons of this dilemma are the differences between the special dual identifications of science centre: the role of the public welfare purposes in the science centre identified by the government, the need of a market player role identified by the science centre itself.

The Identification of the Government on Science Centres

The identification of Chinese government on science centres is closely connected with its understanding in the importance of science and technology, the dissemination and popularization of science, and most of all the role of science centre.

The future of science and technology is determined by the value endowed by the society[2] . In the past half century, Chinese government more and more realized the important role of science and technology. In 1950s, Mao Zedong thought the more the people, the stronger the force, which emphasized the importance of man rather than the power of science and technology. This point lasted more than double decades. By 1978 the Reform and Opening began and the spring for science came in China. On September 5th, 1988 Deng Xiaoping clearly pointed out that science and technology are the primary productive force. At the beginning of the 21 century, Hu Jintao further advanced the strategy theory of building an innovation-oriented country, putting the innovation of science and technology as a national fundamental strategy, greatly improving the capacity of innovation in science and technology and then forming the national competitive advantage. The implement of this strategy calls for increasing the level of research and development in science and technology all over the country and improving the level of scientific literacy for all Chinese citizens.

At the same time, the government in China more and more realizes the importance of the dissemination and popularization for science and technology. In August 1950 Chinese Association for Science and Technology Popularization, the predecessor of Chinese Association for Science and Technology (CAST), was found and preluded the great cause of dissemination and popularization for science and technology in new China. However, a situation that stresses scientific research and looks down on its popularization lasted decades. In addition, scientific workers were unwilling to do this job either. Gladly, this situation greatly changed in recent years. In June 2004 Hu Jintao declared that the innovation of science & technology and its dissemination and popularization are the double aspects of scientific cause. For the first time, the innovation of science and its popularization are stressed equally at national level.

[1] Cheng Donghong: Opening Speech for Chinese and Foreign Science and Technology Museums Forum, 2009.

[2] Christopher Bryant and Michael Gore, the Development of the Public Communication of Science Center: Study on the Australian Public University. Science centers for this century, Sainte-Foy, Quebec : Éditions MultiMondes, 2000.

As Chinese government more and more realizing the significance of science and technology, it began to concern and support science centres which is considered as an important channel for scientific dissemination and popularization. In 1958 Chinese government had intended to build the Central Science and Technology Museum, the predecessor of China Science and Technology Museum (CSTM), which stopped eventually for the shortage of capital and materials. Obviously science centre was not a necessary but dispensable infrastructure for scientific communication at that time. After the Reform and Opening, everything changed. In the National Science Congress in 1978, which marked the beginning of scientific spring in China, many famous scientists such as Mao Yisheng and Qian Xueshen suggested once again to build CSTM and started the long march of its construction. By September 22, 1988, CSTM was founded and opened to society, beginning the cause of science centres in China either. At the same month, Deng Xiaoping advanced the famous point that science and technology are the primary productive power, which is not just a coincidence by chance As the history went into 21 century, science centres are booming in China. In 2008, Chinese government declared in the Science Facilities Development Planning (2008-2010-2015) that it will optimize the layout of national science centres with at least one science centre in large and medium-sized cities. According to the requirements of “Scientific Outlook on Development”, the central government and provincial governments are committed to the development of the science centre which is concerned playing an indispensable role in spiritual civilization construction and economic and social progress. Science centres nowadays become an important civilization symbol for a city. Up to now there are more than 200 science museums in China, including 30 science centres of modern characteristic, though most of them are called science and technology museums. Each year more than 40 million visitors go into the science and technology museums or the science centres. (Refer Table 1)

Table 1.Views and affairs on science & technology in different decades in China

Decades	Views on Science	Science Communication	Science Center Affairs
1950s	The more the people, the stronger the power.	In 1950 Chinese Association for Science & Technology Popularization was found.	In 1958 the construction of Central Science & Technology Museum stopped.
1980s	Science & technology are the primary productive power	In 1978 many famous scientists suggested once again to build CSTM in the National Science Congress which started the spring of science in China.	In 1988 CSTM was found and the cause of science centre in China started.
2000s	Implement Scientific Outlook on Development and build an innovation country.	In 2004 Hu Jintao declared that the innovation of science & technology and its dissemination and popularization are the double aspects of scientific cause.	In 2008 the Science Facilities Development Planning (2008-2010-2015) declared to build at least one science center in large and medium-sized cities all over China; SSTM, GSC and the New Museum of CSTM are found and list in the top 10 science centres in the world for their sizes and scopes.

In the new century Shanghai Science and Technology Museum (SSTM), Guangdong Science Centre (GSC) and the New Museum of CSTM are founded one after anther, everyone of which has been invested about 300 million $ and lists on the top of 10 science centres in the world for its size and scope. SSTM and the New Museum of CSTM both attract 3 million visitors a year. Today science centres in China are playing a significant role in the dissemination and popularization of science and the improving the level of scientific literacy for all Chinese citizens.

However one fact must be pointed out that as to the remarkable development of science centres in China in the past two decades, one reason was that Chinese government and society more and more realize the significant role of science centres in the dissemination and popularization of science and technology, anther important reason cannot be ignored was the booming economy in China at the same time.

Reviewing the long march that science centres in China has gone in the past two decades, there are at least two characteristics which are obviously different from other countries.

First, Science centres in China play a significant role in the dissemination and popularization of science and improving the level of scientific literacy for all Chinese citizens.

Second, the science centre is the public welfare. As to the identification of the science centre, Chinese government defines it with the characteristic of public welfare purpose, a public infrastructure for scientific popularization and an important platform to service the public for science communication.

Third, the government is vital in the construction and development of science centre. The government leads and cooperates with the science & technology circles and the whole society, forming a development path with Chinese characteristics of government-led, point to area, echelon development and then comprehensively promotion. The government concentrates its effort to build a few science centres such as CSTM and then, with this model, puts it forward to the provinces, cities and counties all over China.

The identification and construction model with Chinese characteristic are valuable which was proved by the remarkable development of Chinese science centres in the past two decades. However, this identification and model also demonstrate the shortages which follow up:

Firstly, science centres generally lack vigour and lose the ability of sustainable development. As the public agencies, science centres deeply bureaucrat and play poorly in the market, facing great pressure of development and even survival.

Secondly, there is no mechanism for companies endowing science centre. Without the powerful support of companies and communities, the government lonely sustains science centres, many of them become the heavy financial burden of all level governments.

Thirdly, the geographical layout of science centres in China is unreasonable. Most of them are clustering in the eastern coast areas and large cities, few of them in the middle and western areas and little cities.

Finally, science centres all over China are generally built from a few models and are highly similar to each other. Most of them are copied in some way from several science centres such as CSTM. If one had visited CSTM, he needn't visit other science centres any more. These standardized science centres lack their own characteristic and are short of attraction to visitors.

The Identification of the Science Centre on Itself

As to the development of the science centre, the first and most important key is a precise identification about itself: Who am I? What do I want to do? What can I do? How can I do it? Since its establishment in China, science centre circles spare no efforts to explore the identification on itself: What is the ideal science centre? How to construct it? How to develop it? Gladly, many conclusions have reached in some areas:

Exhibition is the foundation of science centre and education is its soul. Exhibitions in the gallery should be organized by story-line or subject like a poem. Unfortunately, there is no education but exhibitions in some science centre for the chaotic arrangement of exhibitions.

Exhibition should be secured, manageable, scientific-interesting and innovative. The security vetoes other aspects. No security, no exhibition.

The key to the education of science centre is to experience the science & technology and inspire the innovation. It is less important to disseminate some particular scientific knowledge.

As to books, magazines, newspapers, televisions broadcasts, internets and other media, the advantage of the science centre in science communication is to experience the scientific scene.

Child gallery is the most attractive part in the science centre. For example, the Science Paradise for children in CSTM attracts about forty percent visitors with less than one fifth exhibition areas of the whole museum.

Preschool children (hoped a bright future by their parents), primary and middle school students (unifiedly organized by schools) and the retired elders (organized free activities) are the three majority visiting people[3], whose number is about 40 percent, 40 percent and 10 percent respectively. The numbers are slightly different in different science centres.

Temporary exhibition, which needs little money and can easily arrange, is vital to attract visitors and enlarge the influence of science centres.

It is significant to learn from international experiences. The newly built SSTM, GSC and the New Museum

[3] Zhang Chengguang, Probe the New Way of the development for Chinese Science and Technology Museum Industry, 2009.

of CSTM all founded its international experts committee and absorbed international experiences worldwide, which have grown beautiful flowers. It is no difficulty to find that the understanding and experiences on the identification of science centre in China are alike those acquired for many years in international science centre circles and there isn't some innovations any more. Furthermore, these experiences concentrate in the construction rather than the management of science centres. It shows that China has accumulated rich knowledge in the constructions of building and content in science centres and is capable to build international level ones. There is an interesting example. In the course of building some super science centre in China, the child science park had once contracted award to a famous international company. However, the foreign partner withdrew for some reasons and Chinese had to build it alone by studying home and abroad experiences. Nowadays there are more than one million children and parents in one year visiting this science paradise with just 3,800 square meters and the summit of visiting number a day is more than 10,000. All of these not only prove the former point that child gallery is the most attractive part in science centre, but also prove that it is more easily to absorb construction knowledge than to assimilate management experiences abroad.

As to management aspects of science centres between China and other countries, one can also easily find that there is an obvious, even fundamental, difference. Today China is capable to build an international level science centre but cannot find a good way to make it operate smoothly. It is a common situation in China that it is easy to build but difficult to cultivate a science centre. Most of science centres repeat a vicious circle that it is hot one year, cold three years and silent ten years. Audience numbers standstill and even reduce by years. Survival and development generally become onerous problem to them.

There are only two science centres outside this way: CSTM and SSTM. CSTM is located in Beijing, the capital of China. Since its opening in September 1988, it has served more than 20 million visitors at all. The audience number each year achieves 3 million nowadays from 100,000 in its beginning. On October 3, 2010 there are unprecedented 38,000 people visiting it. However, as to the reason of all achievements, a key factor was the seemingly inexhaustible and increasing subsidization from the government in the past decades, which enabled CSTM to greatly enlarge its building and exhibitions every few years and made it abandon all exhibitions to build a whole new museum in a new place in September 2009. It is rare to see such enormous investment from the government in the 200 years' development history of the global science & technology museums or science centres. SSTM is opened to the public in December 2001 and covers the Yangzi River delta which is the richest area in China. With the powerful finance from Shanghai municipal government, SSTM is the national tourist spot of AAAAA standard important science education and leisure travelling base. Up to now, it has attracted more than 18 million visitors by greatly promoting its science education and science travelling functions and widely winning social confirmation and compliments. Its audience number also increases yearly and reaches to more than 3 million a year. Obviously it has gone into a track of healthy development. As to sizes and scopes, Guangdong Science Centre is the largest science centre in China as well as in the world. However, there are just 800,000 people visiting its huge galleries each year. It is still uncertain whether GSC has explored out its sustainable development way.

Unfortunately, the remaining science centres in China are less vigorous and perform poorly in the market few of them have a bright way ahead.

First, the poor finance from the government. For instance, a city science centre in a middle province of China receives only 50,000 $ from the government. It is less to the county science centre that it is 9,000 $ a year[4]. These capitals are obviously far from enough for an energetic science centre that wants to speak loudly in the society. Tianjin Science & Technology Museum is located in Tianjin, one of the four municipalities directly under the central government, and once the largest one in China in mid-1990s with about 400,000 visitors a year. It also faces the financial dilemma nowadays which the lowest fee is 1.6 million $ a year to operate it. However, the local government can just satisfy 40% of its need each year. Furthermore, the tendency free to adolescent in museums more outstands the shortage of capital in the science centre[5].

Second, the science centre performs poorly in the market. The ticket fee is the main source of income for most science centres. However, as to the shortage of capital, the exhibitions are obsolete and slow to replace; the facilities are old and security risks increase. Therefore, it is unable to undertake major activities and then greatly influences the exertion of its function6[6]. As a result, the visitor reduces. So does the ticket fee and income. No wonder, the management comes into a vicious circle in many science centres all over China.

In one word, today the shortage of capital becomes the No. 1 problem for science centres in China. Even

[4] Jin Kejun, the Major Problems and Corresponding Solutions for Mid and Little Science Museums Nowadays, 2009.

[5] LSM, A Few Thoughts on the Sustainable Development of Science and Technology Museums, http://www.donglikewei.com/news.asp?newsid=1917.

[6] Ipid.

though many of them make double efforts to explore solutions such as launching science travel, arranging temporary exhibitions and learning from entertainment industry, etc. On the whole there has still not discovered the fitful new ways of development for Chinese science centres at this stage[7].

Dilemma and Solutions

In view of the whole 200 years' development history and management status of the global science centre, it is not hard to find that science centres in China are facing a structural and institutional dilemma toady, which deeply root in the great differences between the special dual identifications of science centre: the role of the public welfare purposes identified by the government, the need of a market player role identified by the science centre itself.

On one side, the government identifies the science centre as the public welfare agency and gives it financial support. However, except a few museums, all level governments are unable to provide enough financial subsidization. Moreover, the government classifies the science centre as museum then manages and subsidizes it like a museum. However, as everyone knows that the expenditure of science centres is greatly higher than that of museums.

On the other side, as the constitutional design of the public welfare agency, the science centre is deeply dyed with the colour of bureaucracy. With indefinite right and responsibility and without an inspiring mechanism, science centres have limited management capability like most public agencies.

In addition, there is short of the corresponding mechanism for enterprises to donate science centres. For example, the enterprise that endow science centre can reduce or avoid its tax. As a result the science centre almost receives no donation from enterprises and communities, which aggravates the management difficulty of science centres.

It is known to all that the expenditure of science centre in one year is one tenth of its construction fee for its expensive spending on operating and repairing exhibitions. As to the international successful science centres such as Ontario Science Centre and Los Angeles Exploratorium, their expenditure sources generally come from the financial subsidization of government, the income of science centre itself and the donation from enterprises and communities, which are about one third respectively. However, the hard situation of expenditure sources for most science centres in China is that the limited financial subsidization of government, the poor income of science centre itself plus the scarcely donation from enterprises and society. It is no wonder that they generally confront with tremendous pressure of development and even survival.

Therefore, in order to resolve the structural and institutional dilemma twisting science centres in China at this stage, it should ponder and take actions from the structural and institutional perspective rather to adopt some tiny and trivial remedy arrangements. The following maybe some possible resolutions:

All level governments should persist with the public welfare identification for science centres, applying the management system that is different from normal museums and increasing the financial subsidization for science centres.

Give a normal identification to science centres which generally owned by the international science centres: possessing the management subject, with a clear definition of rights and responsibilities, reducing the colour of bureaucracy, bearing the internal and external motivate mechanism, and then fundamentally improving the capacity of management in the market areas because one cannot expect a government officer to be successful in the market. He must become a business person at first.

Build wide channels for enterprises and communities to donate the science centre and expand the sources of income.

[7] Zhang Chengguang, Probe the New Way of the development for Chinese Science and Technology Museum Industry, 2009.

147. Scientific Heritage and Cultural Identity: A Mission Supported by ICTs and School

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Abstract. The paper shows the task to contribute to the construction of the identity, across the scientific heritage, the support of the ICTs and the school. All of three elements are important at the moment of strengthening the self-knowledge and the cultural auto-esteem. We discuss the results of an investigation realized in 2007 in urban and rural schools of Catalonia. The students had the opportunity to prove a virtual itinerary in a zone of the north of Catalonia (industrial heritage) rehabilitated as tourist place.

The project, the Knowledge and Heritage Value of Gerri de la Sal, was planned for working with the school-age public. It involved the design of a series of educational activities and teaching dossiers adapted to the different educational levels interested in exploring the on-line products. On- line and off-line experiences tell us of a public wanting to know about and use those tools available to help them to know their heritage.

The tool itself provides contents adapted for the following subjects: science, biology, technology, and social studies in sixth grade of Elementary School, third grade of ESO (compulsory secondary education), and first course of High School. This complement to the school curriculum represents a research proposal, which seeks to bring heritage itself closer to the school as an alternative to the problems of time, money and displacement.

The project was coordinated by the National Museum of Science and Technology of Catalonia (mNACTEC) and the study of the schools carried out by MUSEIA, Research Group of the Open University of Catalonia (Spain). We observed how the students of the rural zone, near Gerri de la Sal, knew its existence, its importance for the economy and their region, whereas the pupils of Barcelona showed a major ignorance in that matter. The above mentioned results rest on a theoretical part that is approached from the perspective of the public communication of the science and the presence of the ICTs in the heritage and the school.

148. Science Theatre–Obesity and Diabetes

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Abstract. The performance" Obesity and diabetes–is it just a matter of lifestyle?" Has been part of a communication arrangement for social and health workers in eight Danish municipalities, supported by the Danish national foundation for prevention of life style diseases. The project is a collaboration between the Science Theatre and internationally recognized scientists at the University of Copenhagen The incidence of obesity and diabetes is increasing all over the world and is a serious threat to public health and healthcare. It is a general opinion that it is caused by lack of self control and bad habits. However recent research has revealed a strong influence of genetic background, the nutritional condition during pregnancy, early childhood nutrition, the bacterial gut flora and physical activity. As many obese people are stigmatized by guilt and social isolation it is pertinent that they are informed about the scientific facts that may help them to accept and improve their situation. Scientists participate alongside professional actors, dancers and musicians. Science theatre is a performing art where the audience can learn with their senses and feelings as well as their intellect. Science theatre makes complex research understandable to a broad target audience. Complex scientific issues are explained on stage by the scientists. The understanding is facilitated by the dramatic, visual and humoristic tools of traditional theater to help the audience gain new insights. scientists participate alongside professional actors, dancers and musicians. Science theatre is a performing art where the audience can learn with their senses and feelings as well as their intellect. Science theatre makes complex research understandable to a broad target audience. Complex scientific issues are explained on stage by the scientists. The understanding is facilitated by the dramatic, visual and humoristic tools of traditional theater to help the audience gain new insights.

Keywords: Art and science, Science theatre, Interactive communication, Ethical matters, Obesity, Diabetes, Health science

149. Science-Philately–A Tool for Science Communication without Frontiers: India's Contribution

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Abstract. Stamps collection is very much fascinating to every one, irrespective to age and nation. Many people used as hobby including some kings, president, and elites. These attractive pieces of papers is a tool for providing important messages, anniversaries, celebrations, and propagandas and sometimes cultural and heritage of the country. It also provides the detail of overall development of a nation. It is always used as a propaganda medium with which to transfer messages to a broad audience.

Science philately means collection and study of commemorative postage stamps on scientific theme, which provide a useful medium for the study of Science history. As well as, it acts as a useful tool in a Science communication and dissemination of scientific development and Health related issues to broad audience. Science Communication through science philately in the real term science Communication without frontiers.

At the pre -independence era, in India there was handful scientific events, developmental issues and personage appeared on postage stamps. More recently the topic science has become a collectible commodity along with animals, flowers, space exploration, health and socio-cultural themes. There are a variety of Indian stamps which have been issued with a scientific theme.

Today India is also forefront in releasing the Stamps and it too depicted Scientific and health event, eminent scientists including Nobel Prize winners, scientific Institutions. These stamps are the main tools for disseminating scientific thoughts and messages and inculcating science and health related issues among masses.

This paper briefly reviews the contribution of Indian science-philately especially stamps on science personage, institutions, discoveries and special science days cover through Indian commemorative postage stamps.

150. Saranjamshala–CSIR Rural Technologies Gallery

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Abstract. The Council of Scientific and Industrial Research (CSIR), India`s premier S&T organization has a mandate to innovate and shape sustainable rural technologies to help the common people and smaller communities for better quality of life by realizing the use of the technology. It has 37 working laboratories around the country and in the pursuit of strengthening the nation from grass-root level, it has undertaken several R&D programmes and developed over 365 promising technologies for the rural communities in the areas of agriculture (farm & non-farm), drinking water, leather, building materials, natural fibers, ceramics, medicinal and aromatic plants etc. These technologies have shown large impact on the socio-economic conditions of the rural people and CSIR is currently operating a project which aims at bringing solutions to 800 million people in the country under a innovate program called CSIR 800.

CSIR is now continuously striving towards the outreach of these technologies to the rural areas for attracting prospective entrepreneurs. In this process, it has established a Rural Gallery named "Saranjamshala" at Bhopal to showcase its prominent rural technologies for their effective outreach. Models, exhibits, products and other information related to CSIR rural technologies have been displayed in 5 theme showcases and 14 individual laboratory showcases. The gallery is a permanent showcase of CSIR rural technologies to depict the success stories of rural development and is continuously visited by of NGO`s, KVK`s, Rural Artisans, Entrepreneurs' etc. The paper discusses various aspects of CSIR rural technology dissemination and how effectively these technologies have been showcased.

Keywords: Rural technology, CSIR, Dissemination, Rural gallery

Introduction

Technological interventions are vital elements in the socio-economic development of any region. A majority of the world`s population, especially in the developing countries live in rural areas and it is utmost important to develop sustainable and meaningful technologies for improving their quality of life. This would call for significant technological interventions in many areas which include water, shelter, energy, environment, health, food, farm and nonfarm sectors. The Council of Scientific and Industrial Research (CSIR), India`s premier S&T organization and one of the world's largest publicly funded R&D agency has a mandate to innovate and shape sustainable rural technologies to help the common people and smaller communities for better quality of life by realizing the use of the technology (CSIR, 1995).

During the years 1997-2002, CSIR has prepared a plan for its orientation towards rural development programs and brought out a focused program called "Rural Action Program" (RAP). The program is largely concentrated on the effective dissemination modes of prominent rural technologies by the way of publication of journal of rural technology, establishment of a CSIR rural technology gallery and organizing various training programs/awareness programs and Advanced Materials and Processes Research Institute (AMPRI), formerly Regional Research Laboratory, Bhopal has successfully implemented these activities. This paper reveals about the establishment of a gallery consisting of promising CSIR rural technologies which is mainly aimed at popularization.

CSIR Rural Technologies

CSIR has a wide network of 37 laboratories around the country and some of these laboratories, in addition to generating new knowledge, have been making out technologies that will have a special significance for the rural sector. CSIR joins hands with various governments departments and ministries towards meeting the commitment to leverage its relevant knowledge base for the benefit of rural sector, north east region of the country and weaker sections of the society (Vimla, 2007). It has also established new linkages and partnerships by providing technological support for basic human needs of the people living in rural India in key S&T areas of strength.

Rural development through inducting and infusing S&T based innovations in rural life has been a vital mission for CSIR. In this journey it has developed around 365 technologies covering areas like mechanized agriculture, new cultivation techniques, water purification techniques, low cost housing and traditional ceramic products utilizing locale-specific endowments etc. All these technologies are creating lot of employment and wealth generation by improving quality of life and community development. During Eleventh Five Year Plan (2007-2012) of Government of India, CSIR has brought out a focused program called "CSIR 800" which aims at providing a better life to 800 million people in the country by the way of developing cost effective technologies in the areas of health, agriculture, and energy. Apart from providing meaningful solutions, the program largely encourages the successful dissemination of its rural technologies.

Rural Technology Dissemination

Dissemination of rural technologies as such is not the mandate of many CSIR laboratories. But without popularizing its technological base these laboratories can never benefit the rural populations and the issue of effective dissemination has been widely discussed over the years and at various levels. It was during the Tenth Five Year Plan of Government of India, CSIR has brought out program called "Rural Action Program" (RAP) which is largely aimed at showcasing and disseminating the rural technologies (Nandan, 2009). Apart from this, efforts are being made to design successful business models to create sustainable employment.

Saranjamshala–The CSIR Rural Gallery

In the process of its dissemination efforts, CSIR has established a rural gallery named Saranjamshala–a name inspired by the Gandhian literature at AMPRI, Bhopal to showcase its prominent rural technologies for their effective outreach. Prof. V.L. Chopra, Member, Planning Commission, Govt. of India inaugurated the gallery, in the presence of Dr. Samir K. Brahmachari, Director General, CSIR on March 28, 2008. The gallery is presently functioning as a CSIR rural technology showcase. The design of the gallery includes 5 theme showcases and 14 individual laboratory showcases. The theme showcases are the places where collective technological models of different laboratories were placed based on various themes viz., Natural Fibers, Leather, Ceramics and Handicrafts, Food Technologies, Medicinal and Aromatic Plants. The individual showcases hold prominent rural technology products/models of the following 14 CSIR laboratories:

1. Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow
2. Indian Institute of Integrated Medicine (IIIM), Jammu
3. Indian Institute of Petroleum (IIP), Dehradun
4. Advanced Materials and Process Research Institute (AMPRI), Bhopal
5. Central Leather Research Institute (CLRI), Chennai
6. Central Scientific Instrument Organizations (CSIO), Chandigarh
7. Central Food Technological Research Institute (CFTRI), Mysore
8. Central Glass and Ceramics Research Institute (CGCRI), Kolkata
9. Institute of Himalayan Bioresource Technology (IHBT), Palampur
10. National Institute for Interdisciplinary Science & Technology (NIIST), Trivandrum
11. Central Mechanical Engineering Research Institute (CMERI), Durgapur
12. Institute of Materials and Minerals Technology (IMMT), Bhubaneshwar
13. Central Building Research Institute (CBRI), Roorkee
14. Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar

Collection of the Exhibits

After the conceptualization of the idea a meeting was held with nodal officers of the respective CSIR laboratories to decide on the structure and exhibits of the display. Exhibits interms of working models, miniaturized models, original products, brochures etc. It was also decided to place scrolling displays in the gallery for providing the technological details about the exhibits.

Exhibition Plan

Soon after finalizing the type of exhibits, information from all the individual laboratories was collected and based on the material, 5 theme showcases and 14 individual laboratory showcases were made. The five theme showcases were designed to showcase the collective technological models of the CSIR laboratories that are working on common areas like natural fibers, leather, ceramics and handicrafts, food technologies, medicinal and aromatic plants. Apart from this, the exhibits supplied by the individual CSIR laboratory were showcased separately in the form of an individual showcase. Technical information in the local language (Hindi) about the exhibits in both the theme and individual laboratory showcases was placed in the scrolling displays which are attached to the showcases.

Promoting the Gallery

A 25 minute video film of the gallery along with a brochure has been made and sent to various State Institute of Rural Development (SIRD), Krishi Vigyan Kendra`s and other major rural development organizations. These organizations are guiding the prospective entrepreneurs and rural artisans to visit the gallery for getting more information. Apart from this workshops and awareness programs on prominent technologies were also conducted for the NGO`s and rural communities. To build more audiences we have popularized the gallery through media.

Support and Networking

To increase the effectiveness of the gallery we are continuously supporting the visitor's interms of technology transfer and incubation processes. It also involves business meetings with prospective entrepreneurs for preparing sustainable strategies towards marketing and related issues. All these activities are helping us to create a large network of people that are interested to adopt CSIR Rural Technologies.

Conclusion

CSIR is a vibrant institution and rural development has always been a vital mission. It is continuously striving towards the development of promising technologies for rural India and on the other side constantly disseminating its readily available technologies. The CSIR rural gallery "Saranjamshala" is a unique place where prominent technologies were showcased for their effective dissemination.

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151. A Museum for Understanding Biodiversity: The Calicut Initiative

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Abstract. Augmenting the related "Communication, Education and Public Awareness" (CEPA) programmes is a major aspect in enhancing sustainable development and promoting conservation of biodiversity.

Science museums can play a significant role in educating the public on indigenous biodiversity. It is with this objective, that Western Ghats Regional Centre, Zoological Survey of India opened its museum a couple of years ago. The museum is unique of its kind due its special focus on local animal species and is now a prominent point of interest to the student community as well as to the general public.

Keywords: Biodiversity conservation, Calicut, Science musuems, ZSI

Introduction

The United Nations with the declaration of the year 2010 as "The International Year of Biodiversity" has invited the world to celebrate life on earth and the value of biodiversity for our lives. It also reckons a joint action in 2010, to safeguard this 'variety of life' on earth. (http://www.cbd.int/2010/welcome/). For enhancing sustainable development and promoting beneficial conservation of biodiversity, "Communication, Education and Public Awareness" (CEPA) programmes related to biodiversity need to be augmented.

That which is appreciated and valued only, will eventually be saved or conserved. So also understanding what biodiversity is, proves crucial to valuing and conserving it. Attaining a clear understanding about the 'Variety of life' is essential for a critical evaluation of the impacts of human actions on the living world.

Better awareness can be achieved, if initiatives stay focused on local biodiversity aspects. Science museums by explaining and displaying the indigenous biodiversity can play a significant role in educating people on the importance of biodiversity conservation. It is with this objective that the Western Ghats Regional Centre (WGRC), of Zoological Survey of India (ZSI), Calicut, Kerala, commissioned a Museum in September 2008. ZSI, with its headquarters in Kolkata, is a premier organization under the Ministry of Environment and Forests (MoEF), Government of India, and is involved in the study of diversity of animals in the country. The organization conducts faunal surveys, explorations and research leading to the advancement of scientific knowledge on the faunal wealth of the nation.

About the Museum at WGRC, Calicut

The museum at WGRC is unique of its kind due its special focus on local animal species and endemics of Western Ghats (WG), a prime 'Biodiversity Hotspot'. Various displays communicate the current status, vitality, richness and significance of the diversity of animal life of WG. Important concepts in biodiversity which are locally relevant are also presented effectively by maintaining displays of live as well as preserved organisms, through paintings, photographs and also screening short movies. The exhibits set up mainly on a student as well as a layman's perspectives are housed in two floors occupying a total area of about 4500 sq. ft.

In a short span of 2 years since its inception, the museum has attracted a total of 28,749 visitors (as on 24th October, 2010). The museum is open on all week days and entry is free.

All the displays in the museum are thematically arranged. Such a grouping ensures an in depth and focused understanding of the subject to an observer.

Displays are arranged under four thematic categories.

Theme I: Observe nature

Observing nature is a skill requiring attributes like patience and keenness. Displays set up near the entry point demonstrate in particular, the need to develop such attributes as essential prerequisites for observing nature. Model habitats have been set up, where one has to struggle a bit to spot out the creatures placed within. Such displays also help the observer to develop insights on cryptic colourations in animals and explain how a camouflage can really aid an organism in its survival.

Theme II: Wonders of the animal world

Creating enthusiasm in an observer on the topic depends a lot on the content and the presentation style of a display item. For essentially equipping the minds of an observer in appreciating the value of biodiversity, a few among the wonders of the living world have been chosen and displayed.

The 'living fossils': Living fossils are organisms that have remained unchanged even after millions of years. The mysterious Purple frog, the beautiful Nautilus and King crab along with apt write-ups, convey the concept what 'Living Fossils' are.

The record breakers: The smallest and the largest species of frogs in India, the smallest fish species in India, the largest species of moth in the world, the largest butterfly species in India and one of the longest species of earthworms represent the record breakers in the animal world.

The 'curious creatures': The stick insect with its deceptive appearance, the leaf insect even mimicking the venations on a leaf, the flying lizard, the flying fish and the chameleon induce an element of curiosity in the minds of an observer, implanting in them an urge to learn more on the living world.

Theme III: Vital concepts

To communicate on some of the vital concepts in the science of Biodiversity, in addition to the preserved examples and photographs, a few living forms have also been displayed.

Concept-I: Invasive alien species (IAS): Among the current threats faced by biodiversity, those posed by the IAS (non-native organisms that cause, or have the potential to cause harm to the environment, economies, or human health) have been ranked the second.

With the two representatives of IAS of the region, viz., the African Cat fish and the Red eared slider turtle, maintained live, also supplemented by adequate data, the concept of the threats posed by the IAS to the indigenous life forms are well- conveyed.

Concept-II: Endemism: An endemic species (an animal or a plant species with habitat restricted to a particular area) is one of the focal topics in biodiversity and conservation sciences. A live display of one of the most beautiful of the fishes, endemic to the fresh water streams of Western Ghats, the redline torpedo fish, popular by the name "Miss Kerala" has been maintained. This along with the series of preserved specimens of the endemic animals of the region, coupled with display of apt data, imprints in an observer, the importance of the concept of endemism in the field of Biodiversity.

Theme IV: 'A Journey through Western Ghats'

This is the focal theme of the WGRC museum. The first floor is dedicated totally to unveil the rich biological wealth of WG. The section effectively reflects the magnificence and glory of the WG, as well as its faunal diversity, through an elaborate display of representative fauna of the WG, comprising of butterflies, beetles, dragonflies and damselflies, fishes, frogs, tortoises, turtles, snakes and mammals- all supplemented with large, framed photographs and bilingual write ups. The section is equally appealing to a serious researcher as well as a layman and caters information on the data regarding the diversity of the group, conservation status and of general interest.

The video corner, exhibiting short movies on animal life specific to WG generate a lively ambience.

The section also depicts the current threats on biodiversity of WG due to large scale land conversions, overexploitation, poaching and pollution.

Communication, Education and Public Awareness" (CEPA) programmes

As a part of CEPA programmes, the museum also holds regular Poster sessions on contemporary themes viz., 'Climate Change and its Influence on Biodiversity' and IAS. A special publication on WG, a series of brochures highlighting an exhibit each and a variety of colourful stickers on the endemic species are distributed, as supplementary educational aids.

Inspired by the information disseminated by the museum, requests to conduct special lectures, workshops and training sessions on the biodiversity aspects of WG are being received regularly from various institutions, students, teachers and forest officials, which are regularly catered.

Conclusion

The strength of the WGRC museum is its wealth of faunal samples, identified upto species level. Such a museum dedicated to displaying animal diversity at a regional level is the first one of its kind in the state.

The museum is now a prominent point of interest to the student community as well as to the general public. WGRC has also been receiving requests for advisory services from regional as well as national organizations on varied aspects based on the museum. Media coverage and feed backs too in general reflect the success achieved by WGRC in fulfilling the goal of setting up a museum with a difference.

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152. Science Museums as Facilitators for Linking Science with Society

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Abstract. Today we are at the crossroads of civilization, soon entering into a new era of rapid global industrialization. With this rapid growth of our civilization, India, also despite her progress in many fields, especially science and technology still lacks in evoking scientific temperament en masse. Repeated Government plans and policies emphasized an effective science education to make people in general aware of the facts of life in the light of science. Science education grossly lacks the visual inputs essentially needed to inculcate science in the minds of young students. Museums in our society have emerged over the centuries as important organizational components and they are called society's information infrastructure. Their roles and functions, as they have developed over this period, are the expression of a variety of cultural and social practices related to education, research, artistic creativity, entertainment and research. In addition, museums serve as educational institutions both for scholars and general public. Materials from museum are primarily used, to place new knowledge in wider education contexts of all kinds and all levels from kindergarten to university. In the present world scenario, when study is a matter of competition rather than application, a museum can perhaps enlighten the minds of the helpless students by making them learning their subject through fun and enjoyment. The formal education system today does not encourage the natural inquisitiveness essential to nurture proper scientific temperament among the young students who form the bridge between the present and the future. On the other hand the science museums do not contain potential resources to satisfy the querying young minds of the students. The present paper highlights how science museums can adapt themselves to attract the young students and make them learn their subjects in the true science. The study has been made with reference to some notable science museums of West Bengal.

153. Current status and the future of Chinese Science Museums Websites–A Conclusion based on Content Analysis to the World Wide Web

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Abstract. In 1993, the first science museum website all around the world was set up by the Explorium, San Francisco in US. Then more and more science museums open their doors on the Internet. Since 2005 which year is a milestone of improvement of Internet in China, Chinese science museums have built their websites as well. Technologically, these websites are called digital science museum.

This article focuses on all the information about science in the websites of three most famous science museums. And in this research, Content Analysis to the World Wide Web is an important method to illustrate the point. Based on extensive literatures, a context unit- all pages of 3 websites- are chosen with the right time frame as the target is always moving. And visits on science museums in the city of Beijing, Shanghai and Chongqing can help establish multi-level coding units which are well prepared for data collection. By the challenging way, researchers could solve problems presented as follows. What kind of content do these websites include? How do they show them? How do they express 'the nature of science' (NOS)? And what else can they do for audience?

Keywords: Chinese science museums, Content analysis to the World Wide Web, Nature of science

154. Role of Tocklai's Science Exhibitions and Workshops in Educating Common People and Student Community on Health Benefits and Scientific Upbringing of Tea– A Case Study

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Abstract. Role of exhibition in educating and creating science awareness among student and common people is well recognized. It forms a platform where visitors get ample opportunity to express views and can exchange ideas with experts of relevant fields. Tocklai Experimental Station commonly known as Tocklai was established in the year 1911.Ever since its inception Tocklai promotes R & D in tea and has been serving Tea Industry of North East India and the contribution of Tocklai towards the growth of tea Industry of North East India is well documented. Tocklai has developed 185 new tea cultivars which have been widely used by planters. Agro-technology that has been evolved after a series of experiments is currently used by planters for scientific up upbringing of tea plants, pruning, plucking, manuring, and pest control. Tea processing machineries developed by Tocklai are being used not only by planters in India but also used by planters of other tea growing countries of the world. Process optimization for quality tea production is an applied and practical science which has been accomplished with the establishment of model tea factory in 2004.Hosting of science exhibition is a tradition of Tocklai where all aspects of tea growing, tea manufacturing, tea tasting, pest control measures, identification of natural enemies of pests, including beautifully preserved butterflies of Tocklai museum, different grades of tea are displayed. Health benefits of tea are well displayed in the form of posters. Tocklai has also have a publication i.e official scientific journal,Annual Reports, Quarterly news letter, Tocklai news letter, Memorandum, Field management book etc for growers. Students from schools and colleges pay regular visits to Tocklai and interact with scientists, experts to know the basics of life science with special reference to tea. This paper evaluates a few national exhibitions attended by Tocklai and the knowledge that reached the tea grower, students and common people in respect of tea growing and its consumption.

155. Relevance of Outreach Activities in Planetarium

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Abstract. The audience in a planetarium show is mostly heterogeneous; you have people from crying babes-in-arms to snoring 80s. Luckily, a majority comprises students. Some of us also make special shows for students. However, astronomy teaching and learning cannot be just a one-show experience only to be waiting for the launch of the next show at the planetarium. This is not enough. In this presentation the word "outreach" means all those activities that a planetarium engages-in beyond its regular show presentations and not necessarily those performed away from the planetarium. Organisation of lectures by eminent astronomers for general public and students, sky watching with telescope, star gazing sessions held far away from city, quiz, painting essay and other competitions not only make the planetarium a place full of activity but keeps those busy for whom it is done. Our aim is to keep children's interest alive all the time. Therefore, we got to work all the time in numerous different ways to reach this goal.

156. Second Name of Life is Organic Food

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Abstract. Organic refers to an "earth friendly" and health supportive food. Organic grown food is our best way of reducing exposure to toxins used in conventional agricultural practices. These toxins includes not only pesticides many of which have been federally classified as potential cancer causing agents, but also heavy metals such as lead and mercury and solvents like benzene and toluene. Which damage function of our body and cause disease.

Keywords: Immunity, Pesticides, Vitamins, nutrients, Non-organic, Toxin, Fungicides, minerals

Introduction

Whether one's belief is that human life was created by the "big bang" God, our origin is directly connected to the earth below our feet. The body that contains each of us is the only one that we experience. A new one cannot be purchased with all the riches of the world. All the gold in the world will not take the place of health and happiness. Our energy comes directly from what we eat. That food, just like us, is a living entity.

But in the thirst of modernization and industrialization man has contributed pollution to the life and ecology of plants. Increased demand for food has lead to the chemicalisation of agriculture and we have reached on such a stage that modern agriculture is dependent on high yielding varieties, which can only be grown under the influence of fertilizers and pesticides.

The presence of pesticide residues have been detected in various items and in food chain. Even human breast milk is not free from DDT, which was found to have even 2.39 PPM levels. Similarly human blood was found to have a much higher concentration of 12.00 PPM as against of 0.050-PPM safe levels (no effect levels). .

Organic Food

In 1939, Lord Northbourne coined the term organic farming in his book Look to the Land (1940), out of his conception of "the farm as organism," to describe a holistic, ecologically-balanced approach to farming—in contrast to what he called chemical farming, which relied on "imported fertility" and "cannot be self-sufficient nor an organic whole."(1)

Defination

Food that is grown and produced by without antibiotics, growth hormones, pesticides or bioengineering is known as organic food.

The pros in 'going organic' is that organic food is free from artificial chemicals, pesticides, antibiotics, growth-promoters and fertilizers. It is produced using environmentally friendly methods and is free from genetically modified ingredients. Organic foods reduce dependence on non-renewable resources and places emphasis on animal welfare(2) Organic farming, food quality and human health:

How Do Organic Foods Benefit Cellular Health?

DNA: Eating organically grown foods may help to better sustain health since recent test tube animal research suggests that certain agricultural chemicals used in the conventional method of growing food may have the ability to cause genetic mutations that can lead to the development of cancer(3). One example is pentachlorophenol (PCP) that has been found to be able to cause DNA fragmentation in animals.

Mitochondria:. The chemicals include paraquat, parathion, dinoseb and 2-4-D which have been found to affect the mitochondria and cellular energy production in a variety of ways including increasing membrane permeability, which exposes the mitochondria to damaging free radicals, inhibiting a process known as coupling that is integral to the efficient production of ATP.

Cell membrane: Since certain agricultural chemicals may damage the structure and function of the cellular membrane, eating organically grown foods can help to protect cellular health. The insecticide endosulfan and the herbicide paraquat have been shown to oxidize lipid molecules and therefore may damage the phospholipid component of the cellular membrane.

How Non-Organically Grown Foods are Harmful?

When a large number of pesticides are present and their combined effect has not been measured; which of course will give very dangerous view. Various Pathological effects of low doses of pesticides in animals and man are as under.

Immunopathological effects: Immuno-pathological effects of pesticides in animals and man are classified under acquired immunodeficiency or immunosuppression, autoimmunity and hypersensitivity. Eczema in man was found due to maneb, 2,4-D and 2,4,5-T. DDT has also been known to cause type I hypersensitivity reaction. The dust of pesticides is cause of allergic respiratory disorders like asthama. Cutaneous allergy has been known to occur due to contact of pesticide contaminated food items.

Carcinogenic effects: Most of organochlorine pesticides like dieldrin, gamma isomer of BHC, DDT and PCB may cause cancer in liver and lung. Indirectly, a state of immunosuppression for a longer period is helpful in increasing the susceptibility of an animal for malignancy. Since many pesticides are known to cause mutation in chromosomes of man and animals, it is considered that they may also lead to carcinogenicity.

Mutagenicity: Pesticides may cause alterations in structure or number of chromosomes resulting in translocations, mutations and chromosomal breakage. The altered chromosomal number may become lethal during fetal stage. Several pesticides like DDT, Endrin, PCB and HCB are known to cause chromosomal aberrations.

Teratogenicity: There are certain pesticides which causes teratogenic defects in animals. Carbaryl, thiram, propoxur, parathion, leptaphos, 2,4-D, lindane and diazinon are having teratogenic defects in animals.

Neuropathy: Most of the organophosphates, organochlorines carbamates may cause neutrotoxic effects in man and animals including increased irritation, loss of memory, in coordination of movement, ataxia, delayed response, convulsions, spasms and paralysis. Such changes appear due to demyelination of nerves in central and peripheral nervous system.

Nephropathy: The pesticide residues bind with certain body proteins, they may become antigenic. This antigenicity is responsible for initiation of immune response in body and a continuous presence of antigen and antibodies in body may lead to the formation of immune complexes. The immune complexes when produced in excess are deposited in glomerular basement membrane leading to glomerulonephritis, commonly known as renal failure for which patient needs dialysis after a regular interval to survive.

Hepatotoxicity: The pesticide residues in food may harm liver tissue as they are metabolised here. There are instances of chronic liver disorders leading to cirrhosis. Certain pesticides are not so dangerous but their metabolites cause severe damage to hepatic parenchyma. The cirrhosis once starts; it never stops even after withdrawal of the primary cause.

Reproductive disorders: It has been observed that the pesticides are lethal to dividing cells of genitalia. They may cause abnormalities in sperms leading to decrease their ability for fertilization(4).

On the other hand the ova becomes defective and not able to implant on the uterine surface leading to early abortion or miscarriage.

Why Should You Eat Organic Food?

With organic foods you enjoy a superior taste

Organic foods is superior to conventionally grown foods(5) Organic foods often contain less water than conventionally grown foods and thus have a more concentrated flavor. Because organic items are often grown locally, they "ripen on the vine" and are fresher than conventionally grown foods that are shipped from further away. The difference can be subtle, but it is there

You can avoid toxins by eating organic product

Pesticides: By far the largest group of toxins to be largely prohibited from organically grown foods where as Several hundred different chemicals and several thousand brand-name pesticide products are legally used in commercial food.

Heavy metals: The toxic metals cadmium, lead, and mercury enter the food supply through industrial pollution of soil and groundwater and through machinery used in food processing and packaging

. Cadmium, which can be concentrated in plant tissues at levels higher than those in soil, has been linked to lung, prostate and testicular cancers.

Despite lead's long-recognized serious adverse impact on health, especially that of young children, lead solder is still used to seal tin cans, imparting the lead residues found in many canned foods. Even low levels of lead are harmful and are associated with decreased intelligence, impaired neurobehavioral development, decreased stature and growth, and impaired hearing. Mercury is toxic to brain cells and has been linked to autism and Alzheimer's disease.

With organic produce you can benefit from extra vitality: Organic foods are more alive. This is a hard one to prove, but as fruits and vegetables ripen, they incorporate sunlight and nutrients from the soil and store vital energy. Your body uses this vital energy s well as the vitamins and minerals stored in the food you eat.

Environmentally, Organic Food Is Gentle On The Earth: Water and air are our most important resources. Infiltration of pesticides, herbicides, fertilizers and other soluable chemicals into surface and groundwater(6). Some herbicides actually evaporate into the air after application and drift for miles (still having bad effects on plant life!) and some agricultural chemicals bind to dust particles which you breath in during dust stormsution.(7) Organic farmers do not contribute to water pollution. Organic livestock farms are prohibited from being point sources of nitrate.

More vitamins And minerals: A review of 41 studies comparing the nutritional value of organically to conventionally grown fruits,vegetables and grains also indicates organic crops provide substaially more of several nutrients like 27% more vitamin C 21.1% more iron 29.3% more magnesium 13.6% more phosphorus and higher phytonutrients–plant compounds that can fight cancer–than conventional food.

More nutrients: Here are a few of the nutrients that were found in higher levels in the organic foods:

- Chromium deficiency is associated with the onset of adult diabetes and atherosclerosis (hardening of the arteries). Chromium was found to be higher in organic foods by an average of 78%.
- Selenium is one of the antioxidant nutrients that protect us from damage by environmental chemicals. It is protective against cancers and heart disease. It was found to be an average of 390% higher in organic foods.
- Calcium, needed for strong bones, averaged 63% higher in organics.
- Boron, which has been shown to help prevent osteoporosis (along with calcium), averaged 70% more.
- Lithium, which is used to treat certain types of depression, was 188% higher.
- Magnesium, which reduces mortality from heart attacks, keeps muscles from spasming, and eases the symptoms of PMS, averaged 138% more.
- Aluminum has been implicated for years in the development of Alzheimer's disease. It's content in organic food averaged 40% less that in commercial foods
- Lead toxicity, which has been in the new a lot lately, can adversely affect our children's' IQ. It averaged 29% lower in organic foods.
- Mercury, which can cause neurologic damage, averaged 25% lower in organic foods.

The chemicals actually reduce the amount of nutrients in plants after application like vitamin C, beta carotene, and the B vitamins. Betacarotene has been shown to be a stimulant of the immune system, and is sometimes able to prevent lung cancer. They have very clearly shown that chemical residues in the serum and fat cells of women greatly increase the risk of breast cancer.

Table.1 Trace elements present in organic and non organic food

Percentage of Dry Weight Grams Dry				Quantities per 100 Weight				Trace Elements. Parts per million Dry matter			
Vegetable:	Mineral Ash	Phosphorus	Calcium	Magnesium	Potassium	Sodium	Boron	Manganese	Iron Cobalt	Copper	
Snap Beans Organic	10.45	0.36	40.5	60	99.7	8.6 73		60	227	69	0.26
Non-organic	4.04	0.22	15.5	14.8	29.1	0.9 10		2	10	3	0
Cabbage Organic	10.38	0.38	60	43.6	148.3	20.4 42		13	94	48	0.15
Non-organic	6.12	0.18	17.5	13.6	33.7	0.8 7		2	20	0.4	0
Lettuce Organic	24.48	0.43	71	49.3	176.5	12.2 37		169	516	60	0.19
Non-organic	7.01	0.22	16	13.1	53.7	0 6		1	9	3	0
Tomatoes Organic	14.2	0.35	23	59.2	148.3	6.5 36		68	1938	53	0.63
Non-organic	6.07	0.16	4.5	4.5	58.8	0 3		1	1	0	0
Spinach Organic	28.56	0.52	96	203.9	237	69.5 88		117	1584	32	0.25
Non-organic	12.38	0.27	47.5	46.9	84.6	0 12		1	49	0.3	0.2

Recovery from cancer: Tests with people and animals eating organic food show it makes a real difference to health, and alternative cancer therapies have achieved good results relying on the exclusive consumption of organic food. The review [19) cites recent clinical evidence from doctors and nutritionists administering “alternative” cancer treatments, who have observed that a completely organic diet is essential for a successful outcome.

Quality of soil: This was attributed primarily to differences in soil fertility management and its effects on soil ecology and plant metabolism. Organic crops contained significantly more nutrients -vitamin C, iron, magnesium and phosphorus - and significantly less nitrates (a toxic compound) than conventional crops(6).

Antioxidant: The data show that organically grown fruits, and, to a lesser extent, vegetables, contain higher levels of secondary metabolites known as antioxidants and polyphenolics than conventionally grown fruits and vegetables.(8) Current available research shows that these chemicals may prevent heart disease, certain types of cancer, and other mutagenic, oxidative disease processes of the human body.

Protect children: In the aftermath of the Alar scare of the 1980's, a study concluded that the average child is exposed to four times as many cancer causing pesticides in food than are adults, based on the types of foods children are most likely to eat.(9) Food choice can have a substantial effect on a child's future health.

Saves energy: Organic farming is accomplished by less energy consumption. Inputs like fertilizer are naturally occurring and require less processing than substances manufactured by huge chemical companies. Organic food generally travels less miles from farm to market saving energy in transport. Whereas organic farmers incorporate alternative and renewable energy sources into their farming/home steading systems(10).

Many hidden costs are involved with the buying of conventionally produced food products. These hidden costs include billions of dollars in federal agriculture and energy subsides favoring big business. Chemical regulation and testing, hazardous waste disposal, environmental damage, cleanup, illnesses and hospitalizations are other hidden costs. Low prices of conventional foods are also a signal that the farm workers did not receive a fair wage.

Yield: One study found a 20% smaller yield from organic farms using 50% less fertilizer and 97% less pesticide. [Studies comparing yields have had mixed results. Supporters claim that organically managed soil has a higher quality[11] and higher water retention. This may help increase yields for organic farms in drought years.

Pesticides and Farmers

There are studies detailing the effects and side effects of pesticides upon the health of farm workers as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems.[12] In addition, there have been many other studies that have found pesticide exposure is associated with more severe health problems such as respiratory problems, memory disorders, dermatologic conditions,[13]18 cancer, depression, neurologic deficits, miscarriages, and birth defects.

Table 2. Differences between food grown in an organic manner and food grown by conventional farming

Fact	**Non Organic Food**	**Organic Food**
Nutrients	During processing, non organic foods lose some nutrients and such nutrients have to be artificially added back to the food.	Organic foods contain more nutrients, that is, a higher amount of minerals and vitamin C.
Fertilizers	Chemical fertilizers are used to provide nutrients for the growth of crops in conventional farming.	Natural fertilizers like green manure and compost are used for the plants and soil in organic farming.
Pesticides	In conventional farming, there are over 450 pesticides which are permitted for use. Many of these pesticides are toxic.	Pesticides are not allowed in organic gardening or farming
Herbicides	Herbicides are used in non organic farming to protect crops from insects and weeds. Herbicides sometimes leave a harmful toxic residue on the plants.	Methods like crop rotation and hand weeding are used instead of herbicides in organic gardening and farming.
Sewage Sludge	Human waste is used as a fertilizer to grow crops in conventional farming. This contaminated sewage sludge may cause diseases.	Use of sewage sludge is not permitted in organic farming.
Nitrate Amount	Fertilizers contain nitrate as a common ingredient and this nitrate gets converted to nitrosamines, which may be retained in the food and be cancer causing.	Organic food contains lesser amount of nitrates in it.

Environment Pollution	Use of pesticides damages aquatic life. Herbicides and pesticides contain toxic chemicals, which has resulted in lesser number of birds, insects and wild plants on the farmland. Earthworms are essential for good soil health and using pesticides and insecticides reduce earthworm population. This leads to increased dependence of the soil, on pesticides.	Organic farming uses crop rotation to prevent pests, by creating a more diverse ecological system to naturally grow the pest's predators. For increasing the quality of soil, natural manure and composting is done. Thus, the benefits of organic farming are more long term and benefit in fighting problems like degradation of the environment.
Food Safety	Many a times harmful preservatives are added to non organic foods.	Organic foods are safer and better, as they don't use any toxic chemicals.
Number of Consumers	Maximum consumers buy non organic food, as it is cheaper and easily available.	Consumers are shifting towards buying organic foods, with growing awareness.

Cost: Most organic food costs more than conventional food products. Higher prices are due to more expensive farming practices and lower crop yields. but the costs of not eating organic can be even bigger as you will likely have higher healthcare bills and a lifetime of disease and illness. These and many other health benefits of organic foods have been brought to the attention of the UK government (14) Over the course of weeks, months, years, and decades, the toxins accumulate and the consequences can be drastic. If and when you reach the point of disease, you may wonder why you're suddenly sick. However, it wasn't sudden at all and maybe that's something you should consider next time you're buying food. So eat oraganic food, keep healthy and live a long life.

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157. Fundamental Rights Encompassing Science Journalism

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Abstract. Journalism is a means of generating concepts of life. Many science journalists work only for earning their livelihood, but it could be different with some others. The press has a responsibility to impart the best of knowledge and also to develop ethics and values in the readers. The need of the hour is a new concept of science journalism, an independent journalism with specific rules and knowledge.

It is well versed that the Indian civilization is quite old and is a treasure of philosophical values. The fundamental rights given to an Indian citizen by the constitution is a step towards self development and inculcation of historic values. An average media person has values and is well equipped with all the techniques of journalism. In science writing his knowledge should be specific and value oriented. He may or may not agree with a scientist on one hand and a human activist on another. A science journalist shall also be acquainted with what is science and its economic values. In the present paper, we have analyzed the requisites of science journalism in context to the constitutional values.

158. Modern and Ancient Sciences to go Hand In Hand

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Abstract. India is a land of ancient and diverse traditions. The knowledge flows from Vedas and various other texts which have been passed down the generations. The science was practiced by the vedic people long before the modern technology was introduced. Native or traditional knowledge is a metaphor for what happens when humans experience and participate with the natural world. Indigenous knowledge is not static and hence modern science. It has sacredness, livingness and soul. It is also helpful in survival of the cultural identity. Indigenous knowledge is also evolving and new knowledge is generated from the traditional knowledge and hence modern science. Contemporary scientific knowledge denies the relevance of traditional knowledge and sees this knowledge as a means of denoting all that they know imposes a way of life on them that is shackled to the past and does not allow them to change. If this ancient knowledge can be used as a foundation to modern science in students understanding of scientific concepts, it will be much easier as it will provide a well recognized spontaneous knowledge. The richness and complexity of local knowledge systems derive principally from the fact that they incorporate two very different world views. In the present paper, we have cited examples from the vedic texts that can be incorporated in the teaching of modern science and analyzed how simple it can be to teach modern science with examples and concepts from our traditional texts.

159. Science Education and Advertisements

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Abstract. Today in modern world everybody runs behind the fake and it has generally become a trend both in fashion as well as in education. This trend has also affected the students. Scientific temper describes an attitude which involves the application of logic and evidence of basic and pre-conceived notion. Discussion argument and analysis and research are vital parts of scientific temper. Today we find a decrease in scientific temper and science is disappearing from the priority list of students. Students study in science stream up to a certain level and then change their stream because of insufficient knowledge of the fascinations of science. Everywhere, we see advertisements attracting a student for a career in engineering or management claiming high results. Is there any advertisement or any other communication to the student about perspective careers in science and what role do scientists play in building the society. In the present paper, we have carried out a detailed study of the measures required to inculcate scientific temper in the students and to communicate the fascinating prospects of career options in science.

160. Study on the Strategies for Science Museums to Develop the Public's Scientific Literacy

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Abstract. As one of the most important places for science popularization, science museums undertake an important task to enhance scientific literacy of the nation. But so far, it's still not clear about the concept of scientific literacy, and how to establish a clear path for reinforcing quality education. Considering the experiences of education activities for science museum, the authors try to give an concrete, easily operated concept to "scientific literacy", three dimensions for which including scientific thinking, scientific spirit and scientific approaches are discussed in detail. The authors divided scientific thinking into two levels in this paper. The first level was considered as the reasonable ideas about the general law governing the nature and the existence and development of human society, such as the thoughts about materialism, development and universal constant. The second level was considered as the scientific consciousness and the way of thinking embodied in people's activities about science research, technology development and industrial innovation, such as the crisis consciousness, economy consciousness, critical thinking, reverse thinking and so on. The analysis and division will help transformation of the abstract scientific ideas into specific content to facilitate the implementation. This will contribute very much to audience education in science museums. Science museums can cultivate the scientific thinking by organizing various activities, such as the debate, the science drama and the role playing games. The spirit of science is also divided into two levels: the first level is considered as the spirit when we deal with the relationship between the human and the nature, such as the brave exploration spirit, the skeptical spirit, the critical spirit and so on; the second level is considered as the spirit when we deal with the relationship between the humans, such as the cooperation spirit, the wolf spirit, the tolerance spirit and so on. Thus, abstract spirits of science have been materialized into the concrete ideas to facilitate the implementation. Science museums can cultivate the spirit of science by the organization of lively forms of activities, such as the scientific experiments, the outward development and other games. The scientific approaches are divided into three levels: the first level is the basic method each subject disciplines used, as the spectrometry widely used in the physics; the second level is the universal method used by all science researches, such as the empirical method, the numerical method, the logical reasoning and so on; the highest level is the philosophic method, which regarded as the guidelines, such as the method of case by case. Thus, abstract science approaches have been materialized and carried out. Furthermore, through cognitive and psychological analysis, the authors divided the visitors in the museums into five types: the children, the teenagers, the youngsters, the middle-aged and the old folks. The detailed and feasible suggestions are put forward to enhance different people's qualities by educational activities in science museums.

Keywords: Scientific literacy, Science center, Objective, Measure

161. Science Theatre: A Novel Tool for HIV Interventions in South Africa

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Abstract. Science communicators are playing an increasingly active role addressing societal problems where science and human behaviour play roles. HIV AIDS is amongst these problems, and is particularly acute in South Africa. This paper investigates whether an HIV science theatre show influenced HIV associated intentions and behaviour of South African youth (n=697). The theatre piece significantly changed intentions, while gender, age, rural/urban background and audience response all influenced change. Provisional evidence of behaviour change was found 2-4 weeks later. These results have implications for science theatre as a behavioural change agent and science communicators' roles in addressing society's big problems.

Keywords: HIV/AIDS, Science theatre, Science centre, Youth, Intention, Behaviour change

Science Theatre as a Change Agent

The interface of science and society is where much of science communication activity is focused. Increasingly, that focus is being called upon to raise awareness of societal issues where people's behaviour has a large bearing on a problem – climate change and HIV/AIDS being prominent examples. The aim of such efforts is to give people greater awareness of the science and provide information in engaging ways so they can make informed decisions. Where the scientific consensus is largely polarised and suggests action, such as with human contributions to climate change, science communicators sometimes aim to foster behavioural change.

Science theatre is an underutilised format in behaviour change communication. Science theatre can be broadly divided into two types: stage plays, often with a historical basis, such as Michael Frayn's Copenhagen; and demonstration-based science 'shows' which are commonly performed in science centres. In this paper, science theatre is used in the latter context. Science theatre has huge potential as a change agent as it has been shown to facilitate learning and positively influence attitudes [1,2], be amongst the most memorable parts of science centre and museum visits [3], and foster emotional engagement [4]. Moreover, it is widely practiced, adaptable to most topics and able to incorporate aspects of behaviour change theory such as modeling desirable attitudes and behaviours. Despite its apparent power, however, science theatre is rarely used to directly influence specific behaviours. Research in this area could not be found in the literature. In contrast, traditional theatre approaches have been shown to be effective in promoting behavioral change, including behaviours associated with HIV [5,6]. This begs the question: can science theatre be a tool for HIV behaviour change? This is the central concern of this paper.

This paper investigates a novel HIV AIDS intervention targeting high school students visiting a science centre in South Africa's KwaZulu-Natal (KZN) province. The research focused on attitude and intention changes from an HIV AIDS science theatre show, which formed the intervention's major component. It also gathered provisional evidence of actual behavior change 2-4 weeks later.

HIV/AIDS in South Africa

South Africa has the largest HIV epidemic globally, with an estimated 5.7 million people HIV positive and 18.1% average prevalence as of 2007 [7]. The human toll of the epidemic is profound: in 2007 approximately 950 people died each day; 1.4 million children under 17 were AIDS-orphans having lost one or both parents; and 460 000 people were receiving HIV drug treatment, although 1.7 million needed it. After a history of government mismanagement of the problem [8], recent developments have been more positive with a national prevention and treatment campaign launched during 2010 and promising behaviour changes, especially amongst youth [9].

South Africa's KZN province, where the current research was conducted, has been hit hard by the epidemic. Of the nine provinces, KZN has the second highest number of new infections with 134 000 annually [10]. Prevalence in rural areas very close to the science centre studied in this paper show "some of the highest population-based infection rates yet documented worldwide", with 27% of females and 13.5% of males HIV-positive [11].

Within the South African epidemic, youth are disproportionately affected, yet offer some of the most promising opportunities for behavioural interventions. As most HIV infections occur in adolescents and young adults [7], reaching them before and during this stage is critical. A national study found 34% of new HIV infections occur within the 15-24 year age bracket, with females accounting for 90% of those infections [10]. In rural KZN close to the science centre, comparing those aged 15-19 and 20-29 is startling, prevalence rising from 11.2% to 40.5% for females and 2.4% to 29.8% for males [11]. The same study reported that 13 times the number of females compared to males were infected among 15-19 year olds. Clearly, effective interventions targeting high school age students could have a huge impact, both in keeping youth HIV-negative and developing knowledge and behaviours to keep them so in the longer term.

Given South African science centres' clientele are typically school groups, they provide a novel way to deliver science-based HIV AIDS interventions. These interventions can communicate information around HIV risk behaviours, while also exploring the science behind HIV, the immune system, and so on. The intervention studied here addressed all these aspects, while the research focused on behavioural intentions and outcomes.

Behaviours associated with HIV in South African youth

HIV behaviours can be broken into those that prevent/risk HIV transmission (HIV risk behaviours, such as condom use) and those related to HIV (HIV related behaviours, such as discussing HIV). Both were investigated in this study.

Unsafe sexual behaviour groups together a number of HIV risk behaviours and is by far the main vector for HIV transmission in South African youth [12,13]. Approaches to address this in adolescents usually promote abstinence and encourage youth that are sexually active to use condoms and not have multiple concurrent partners – a well known example in South Africa is the 'ABC' campaign which used the mantra 'Abstain, Be faithful, Condomise'. The intervention under study used a similar approach, primarily promoting abstinence, with using condoms and not having multiple partners as secondary messages. The balance of these three messages was tweaked accordingly depending on age groups. The logic was that a clear primary message of abstinence could have the greatest effects, however messages on multiple partnering and condoms were needed for those who would not abstain. Another concern was that focusing on condom use primarily could send a message that to protect oneself from HIV one need not abstain so long as condoms are used. This is true in theory, but evidence suggests it does not work in practice. The gap between awareness and behaviour is large–one study of KZN Grade 11 students found 85% of students agreed that it was important to use condoms every time and 86.4% said it protected them from sexually transmitted infections, yet only 46.2% reported actually using them every time [14].

HIV-related behaviours are also important in addressing HIV AIDS and are mainly related to discussion and openness of the issue. They include reducing HIV's stigma, talking about HIV, increasing awareness of treatment, encouraging testing, and knowing one's HIV-status. These aspects were also dealt with in the theatre show and research.

Method

A science theatre show The Alarming AIDS Adventure was presented to secondary school groups visiting the University of Zululand Science Centre. The show was the main intervention component, however also included were an HIV game, career advice, and a regular science centre visit. Other elements are in development.

The theatre show follows two characters – a curious student and knowledgeable scientist – as they learn about HIV through multimedia, models, and demonstrations. It was presented in both English and isiZulu language depending on audiences. Content covered HIV behaviors, the immune system, viruses, HIV biology/genetics, and the related aspects previously outlined. The plot climaxes as the audience are shrunk and taken into the body of a person engaging in risky behaviours to track down HIV. The show concludes with a 20-volunteer demonstration highlighting the behaviours that spread HIV.

Students completed pre- and post-show surveys mainly containing 5-point likert-items on intentions; the post survey also assessed audience ratings of the show (i.e. interest, understanding) and some open-ended questions on behavioural intention. Integrated models of health/HIV behaviour place intention as the end point for other influencing factors and as the key predictor of behaviour [15,16]. Hence intention was the primary research focus, however, other factors that lead to forming intentions were also considered including attitudes, self-efficacy, self-reported knowledge, and normative pressures – all henceforth referred to as intention. Demographic information including age, gender and geographic background (rural or urban/township) was also recorded. Follow-up research investigating actual behaviour and impacts comprised an additional survey and focus groups. To promote open discussion these were run separately for male and female students by a local facilitator of the same gender.

The Australian National University Human Research Ethics Committee approved the research. Consent was gained from teachers and students.

Results

Sample

As many as 697 students completed the final survey, following piloting and survey refinement. The sample included approximately equivalent numbers of males (n=337) and females (n=351), and twice as many urban (n=456) compared to rural students (n=241), as shown in Table 1.

Table 1. Sample demographics

	unknown			female
male	total	rural		1
113	127		241	urban
8				238
210	456	total		9
351	337	697		

Follow-up research involved 19 students from two schools, one rural (seven females; two males) and one urban (five females; five males).

Changes in intention

Statistical tests of pre and post survey scores were used to determine significant changes in intention toward HIV risk and HIV related behaviours. Most intentions showed highly significant changes, including resisting peer pressure, wanting to learn more, knowledge of transmission methods, talking to family, and two measures each of abstinence and self-efficacy. Condom use and having an HIV test were of borderline significance, while being worried about catching HIV, talking to friends about HIV, thinking unprotected sex was OK, and trying to get more information on HIV were non-significant. While scores for non-significant items indicated safe or desirable intentions, they point to areas where the show could be refined.

Factors influencing intention change

Modelling was used to determine which factors contributed to post-intention, and hence intention change. Post-intention was largely determined by pre-intention, that is, student's initial baselines were the greatest factor for their final intentions. Importantly, however, four of the student's ratings of the show also significantly predicted the post-intention scores – more positive ratings of the show led to greater changes in intention. The contribution of show ratings to post-intention was, however, more modest when compared to pre-intention. Significant rating items were student's interest, enjoyment, self-reported learning, and understanding. In summary, this suggests that although prior intention is the greatest contributor to final intention, nevertheless interest, enjoyment, and self-reported learning/ understanding are all also associated with intention change. It is important to note that demographic variables had indirect effects on intention change via all the factors mentioned above, as is explained below.

Demographic effects

A number of statistical techniques were used to assess demographic differences and how these differences influenced intention change. Demographic differences were evident in both initial intentions and ratings of the show, and hence played a major role in intention change.

Looking generally at intentions, females had more positive intentions than males, and gender differences were large in urban students and almost absent in rural students. Urban students had more positive intentions than rural students, and these differences were greater in females compared to males.

Turning to show ratings, a similar pattern emerged. Rural students gave significantly less positive show ratings than urban across all four rating measures significant for change, while males showed significantly less positive scores on two of the four measures.

Age also showed significant differences across almost all intentions and significant ratings. In general, younger students had more positive results and this declined with age, trending to more negative results for about 15 years and above.

Taken together, demographic variables were critical in understanding how intention changed as they affected both initial intentions and show ratings. Females were more positive than males; urban were more positive than rural; and students younger than 15 were more positive than those older. The implications of this point are taken up below.

Follow-up research

The focus groups and follow-up surveys provided evidence of HIV risk and HIV related behaviour change two to four weeks after the show. Data was largely qualitative in nature and is illustrated by indicative quotes.

When asked if students had been reminded of the show by life events: “Yes, I was at a party at night and I’ve got a boyfriend, [and] he wanted to have sex with me, then I refused because of getting HIV” (20 year old urban female).

However the show was by no means 100% effective, though still had positive effects: “After the show I was blank in mind one day and I had unprotected sex, after that I was blaming myself remembering how the disease work” (18 year old urban male); “I will touch my boyfriend in other ways now, not like previous” (14 year old rural female).

The interviews also indicated students were seeking further information, discussing HIV with family and friends and choosing single partner relationships. It should be noted the follow-up research was provisional in nature and detailed analysis of focus group transcripts is ongoing.

Discussion and Implications

This study provides evidence on the power of science theatre as an intervention to change behaviour, and the effectiveness of rolling out such interventions through science centres. The research shows that the theatre show was able to influence a range of intentions associated with HIV AIDS across a large sample, and this contributed to behavioural change in the short term. Moreover, it elucidates factors that are important for understanding intentions in this context, namely initial intentions and their underlying facets, elements (ratings) of a show that facilitate change, and the role of demographic variables. These three factors should be considered when designing and developing science theatre based behavioural interventions.

First, having knowledge of the current behaviour and intention of your audience is important for design and delivery of the intervention [17]. This study looked primarily at behavioural intention, however deeper knowledge of the factors that contribute to intention will be helpful for any intervention. These include some of those studied here such as attitudes, normative pressures and self-efficacy, which, amongst others, have been shown to be important to behaviour in a range of contexts including HIV AIDS and those affecting the environment [16,18,19]. A limitation of this study is that factors that facilitate translation of intention into behaviour, including behavioural skills and external barriers/promoters, have not yet been seriously tackled in this intervention and hence were not researched. These remain crucial elements for truly effective behavioural interventions. Understanding all these elements, either through formal formative evaluation or informal methods, will allow science communicators to more effectively change behaviour.

Second, the result that certain features of the theatre show–namely interest, enjoyment, self-reported learning, and understanding–were important to facilitating change is a significant finding. While anecdotally acknowledged as good features for any theatre show, this is the first research to demonstrate that audience interest and enjoyment can contribute to intention change during a science theatre show. Interest and enjoyment are the emotions thought to work together in intrinsic motivation [20], so in one respect this result is not surprising. It does however highlight the need for science theatre presenters to heed the role of emotions, especially that of interest and enjoyment, in not only engaging but also motivating change. The significance of ratings of self-reported learning and understanding in the change model could mean several things: it could be the feeling of understanding and competence, or actual learning, or both, is important for change. This stresses the obvious need for appropriately pitched shows, but links between actual learning and intention change require further research.

Third, results that different demographics have significantly different starting points and responses (ratings) have implications for development of the theatre itself and adjunct components of the overall intervention. In this study, rural, male, and older students had less positive initial intentions and gave less positive ratings of the show, which contributed to less positive final intentions. Careful examination of which intentions (which is beyond this paper’s scope) would allow targeted modifications to the show for different audiences. Another possibility is additional intervention components which target a particular behaviour, for all or just selected demographics as necessary. One example from this research is the behaviour of taking an HIV test, which could be addressed via a workshop or exhibit.

It should be noted, however, that in addressing male-specific problems this is not done at the expense of females, especially given the drastically higher risk of contracting HIV for South African adolescent females.

Broader Implications for Behaviour Change Programs–a Call to Action

This study has implications for the role of science theatre, centres and communicators in addressing societal problems where behaviours are key. HIV AIDS and climate change are but two examples of major problems where awareness of the science involved can be leveraged to promote behaviour change. Too often, science centres and communicators feel their remit is to educate, raise awareness and sometimes engage emotionally around scientific issues. This is not to downplay the importance of these aims, but to emphasise that in some cases there is a moral imperative to do more. Science centres are well placed to address these issues; they have the infrastructure, human resources, audiences and skills to deliver interventions. Of course, changing people's behaviour is not to be approached trivially and there is a fine ethical line between sensible guidance based on science and opinion-driven manipulation. All that said, few would challenge the ethics of leveraging scientific awareness to promote behaviours to keep youth safe from HIV, or allow people to contribute to mitigating climate change through responsible environmental behaviours. These are areas where the science is for the most part polarised, hence one can argue for science communicators to present the facts and the implications they have for people's behaviour, allowing people to make informed decisions. In this way, science communicators can become agents for behavioural change.

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162. China Popularization of Science and Technology (PST) Infrastructure Development and Trends

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Abstract. The popularization of Science and technology(PST) infrastructures are important public service platforms for science and technology popularization, which including six main major categories as following: natural science museums, science and technology education bases, grassroots PST infrastructures, internet PST infrastructures, science popularization caravans and science and technology museums. In 2006 the Chinese Government promulgated the" Outline of National scientific literacy action program", and PST infrastructure construction project was taken as one of the four basic projects in the outline. Subsequently "PST infrastructure development plan" was issued to promote a comprehensive, coordinated and sustainable development for China's PST infrastructure, and then to provide the PST service support for enhancing of civic scientific literacy.

In 2009, for the first time, China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China's PST infrastructure development status. Firstly, the author studied and established the overall evaluation index system for China's PST infrastructure development and six separate assessment index system for each category of PST infrastructure.Secondly,by using these evaluation index, Monitoring and evaluation on PST infrastructure was carried out and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status was obtained. At last, a series of further analysis on both successful case studies and reasons for major problems were conducted, and then the Author proposed several solutions on relevant issues. On The basis of this study, Report on Development of China PST infrastructures in 2009, as the first annual report, was completed and officially published. These results can not only lay a solid foundation for annual monitoring and evaluation of China's PST infrastructure project in future, but also provide policy making support for accelerating China's PST infrastructure construction. And the author believes this research will be a precious reference for other countries and regions in PST infrastructure development.

Keywords: Popularization of science and technology (PST), Infrastructures, Development status and trend, Monitoring and evaluation, Index system

163. Learning Science in Interactive Ways at the uMthatha Science Festival: Beyond the Classroom Walls

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Abstract. Grahamstown is renowned for its national science festival (Scifest). The festival includes various activities such as workshops, talks/lectures, exhibitions, shows, experiments and so on. These activities are co- ordinated by Scifest Africa. The aim of the national science festival is to demystify and make science, technology, mathematics and engineering accessible to school learners and members of the community.

A major challenge for an event of this nature, advertised at the national language, is that learners in township and rural schools outside Grahamstown are unable to attend Scifest due to financial constraints. As an attempt to address this problem, the idea of regional festivals was mooted. Scifest Africa approached the Embassy of Finland for funding, with which it has strong links. The partnership between Scifest Africa and the Department of Education, supported by the foreign donors, led to the organisation of the first regional festival, which was held in uMthatha in 2008.

Following the success of the event, the new director of Scifest Africa secured funding from the Embassy of Finland for another regional festival. An evaluation of the event was commissioned to the leading authors of the present paper, to bring an external perspective. The goal was to identify challenges and areas for improvement in order to turn the regional festival into an annual event like the national science festival in Grahamstown. This paper reports on the evaluation of the 2009 uMthatha regional festival, whose specific target group was grade 10 – 11 learners in the uMthatha region.

Data were gathered through using questionnaires, informal semi-structured interviews and focus group discussions, field notes and reflections. To make the evaluation participative and to enhance its validity, questionnaires were given to the organizers (to get an insider perspective about this initiative), the presenters, educators and learners. The evaluation sought to establish the quality of the experiences of all the participants.

The mutual collaboration between Scifest Africa as the main organizers and the DoE officials contributed to the high quality of the event by providing support for presenters. In order to improve learners' experiences of the event, two key challenges need to be addressed: lack of subject content knowledge (this was apparent particularly in areas such as physics) and the language barrier. The latter point could be addressed by diversifying the composition of presenters to include speakers of isiXhosa, the mother tongue of most learners. The use of metaphors and analogies proved to be helpful in encouraging learner engagement, but needed to be made more relevant to the learners' everyday lives (Smit, 1998; Kasanda, Gaoseb & Lubben, 2002). This evaluation indicated that there is a great potential to develop meaningful learning through events such as science festivals, provided that follow-up support is given to educators and learners in their school contexts. By the time of the conference, analysis of the data will be completed and more insights will be available.

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164. Motivator, Supporter, Trainer: Science Centres and their Role with Primary School Teachers

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Abstract. Can informal science education institutions (ISIs) influence the self-efficacy of pre-service and in-service primary school teachers? The results of this research showed that four hours of science centre style workshops increased the science teaching self-efficacy of pre-service and in-service teachers, with observable results for at least 11 months after the completion of the workshops. Participants identified science centres as a source of inspiration, support and training for teachers. Science centres, and arguably other ISIs, can positively influence the science teaching self-efficacy of teachers with long term effects, and partnerships between the two sectors could enact positive reforms within science education.

Keywords: Informal education, Primary teachers, Science teaching, Self-efficacy beliefs

Introduction

Australian primary school science is often neglected, receiving less than three percent of total teaching time in the classroom [1]. Teachers acknowledge that they do not feel adequately prepared to teach science [15], some even admitting they fear it [2,16]. This is not limited to beginning or novice teachers. Highly experienced Australian primary teachers are just as likely to lack confidence in their ability to teach science as those teachers in their first few years of teaching [24].

A consequence of this science avoidance is a body of students who are disinterested and disengaged in science. Science education is no longer just about creating the next generation of scientists. It is vital for ensuring the scientific literacy of society [9], enabling them to adequately function in a rapidly evolving technological age. Yet science education is falling short, on all counts.

Research has found that student disengagement with science begins as early as primary school, and is compounded in high school [22]. A study of student outcomes in science high schools in Victoria, Australia, found that the single biggest influence on student achievement in science was the teacher[35]. Successful educational reform is dependent on teacher change [32].

Self-efficacy beliefs of teachers

Teachers' science teaching self-efficacy beliefs have been identified as one of the most consistent characteristics researchers can use to evaluate teaching and learning, including as a predictor of teacher behaviour [13,40]. Although many studies have examined the science teaching self-efficacy beliefs of in-service teachers [see for example 33,41], much less is known about the beliefs of pre-service and beginning teachers [7,23].

The concept of self-efficacy was introduced by Bandura [5], who described two different aspects of self-efficacy: 'efficacy expectation' which deals with an individual's belief in their ability to achieve a desired outcome or behaviour; and 'outcome expectancy' which describes the individual's belief that the achievement of the desired behaviour will have a desirable outcome. Riggs and Enochs developed the Science Teaching Efficacy Belief Instrument based on Bandura's efficacy concept, facilitating examination of these beliefs of in-service [33] and pre-service [11] teachers.

Understanding the environmental influence on teachers' beliefs is crucial for evaluating the influences on teachers' beliefs and practice [21,23]. The effectiveness of professional development undertaken by teachers within the same environmental context has been found to be more effective than the results seen with disparate groups of teachers [29]. Few studies have examined the impact of the school environment on a science teacher or vice versa, limiting our understanding of how to achieve science education reform [23]. The potential influence of the informal environment, such as that of informal science institutions (ISIs) should also be considered.

Informal education–a potential solution?

The main aim of ISIs is to increase the general public's awareness, enjoyment and excitement about science

[37]. One of the biggest challenges for ISIs is engaging and motivating reluctant teachers of science [20].

Typically, ISIs employ constructivist principles in their content and programming, using hands on activities to allow construction of ideas and knowledge though personal experience [38]. Constructivist principles recognise the prior experiences of learners, acknowledging that any new experiences will be framed in the context of prior knowledge and experience [18]. A constructivist approach defines learning as having occurred "…when there is a connection between thought and experience" [27].

Although our understanding of the learning processes and outcomes that occur in museums and other informal education environments has been improved and increasingly well documented in the last few decades [39], little is still known about the impact of ISIs, particularly in the area of teacher training or professional development (PD) [3].

Of those studies that have examined the effects and impacts of PD delivered by ISIs, the results indicate positive outcomes [25]. Perera found that one day science PD workshops modelled on constructivist principles were capable of facilitating conceptual change in teachers [30]. This is in contrast to other evaluations, which found that the results of science based PD delivered via formal means do not show the same levels of success as those attained in other subject areas [19], irrespective of the duration of the PD activity [10].

In a survey of their preferred science PD characteristics, teachers overwhelmingly asked for it to be delivered by an outside expert, and to contain practical ideas and activities [4]. ISIs are already considered by many teachers to be experts [12]. Previous studies have shown that partnerships between ISIs and schools are capable of facilitating student engagement in science [17]; others strongly advocate for these partnerships as a new way forward for achieving science education reform [39].

The aim of this research was to examine if PD workshops from a science centre could influence the science teaching self-efficacy beliefs of pre-service and in-service teachers. The workshops used constructivist principles as the basis for engagement, with the emphasis on participants exploring the activities and learning about science "… with the same methods and strategies as students should learn science in schools" [31:p190].

The research presented here was part of a larger doctoral study. The research questions examined in this paper are:

(1) Do science centre style, short PD workshops have any effect on pre-service and in-service teachers' science teaching self-efficacy?

(2) Is there a role for informal science education institutions, like science centres, with teachers?

Research Method

Eight pre-service teachers in the final year of their degree and 13 in-service teachers (six from a New South Wales-NSW-school, seven from an Australian Capital Territory-ACT-school) with varying levels of experience participated in this year long study. Each cohort contained one male, the rest of the participants were female. Pseudonyms are used in the presentations of these results. Each participant completed a series of four workshops developed by a science centre, on topics such as fluids, climate change, music and sound and physics. Each workshop consisted of around 10 hands-on activities using simple, every day materials to demonstrate a scientific principle.

Participants completed an initial STEBI survey (STEBI A for in-service, STEBI B for pre-service) prior to the workshops to gather the baseline of their efficacy beliefs (Period 1). The STEBI surveys were administered again immediately after the series of four workshops were completed (Period 2), then four months (Period 3) and 11 months after completion (Period 4). At the final sample period (Period 4) the pre-service participants were given the STEBI A instead of the B, as they were now teaching schools. Both STEBI instruments have been validated for use with primary school teachers in Australian primary schools [8,14]. Participants were interviewed at Periods 3 and 4, to help gauge the usefulness of the workshops to teaching practice and to explore how teachers' perceived ISIs like science centres, and what they saw as roles for ISIs. Questions about other professional development activities were included to try to ascertain the extent of the influence of the workshops [see for example 36]. Additional contextual questions were also included to determine the positive and negative influences in teachers' environments.

Analysis

The STEBI-A has 25 items, the STEBI-B 23 items, each requiring the respondent to answer on a five point Likert scale. The STEBI (A and B) are constructed of two scales: the Personal Science Teaching Efficacy (PSTE) and Science Teaching Outcome Expectancy (STOE) which denote their relationship to Bandura's two factor theory of efficacy [6]. The items for these two scales are scattered randomly thorughout the instruments. For each instrument the PSTE and STOE scales are added, generating a score for each scale. Typically, analysis of the STEBI instruments involves factor analysis to ensure internal reliability and construct validity of the two scales. Given the small sample used, this was not possible. As an alternative, the results collected at Period 4 (STEBI A) and Period 3 (STEBI B) were analysed using Cronbach's alpha.

The STEBI A returned alphas of 0.914 for the PSTE and 0.776 for the STOE scale. Items 9 and 20 (both from the STOE scale) had a corrected item total correlation value of 0.3 and were excluded from all analyses of STEBI A [as per 33]. With these items excluded the STOE scale Cronbach's alpha was 0.814. The alpha values for the STEBI A were the same as or higher than those reported by Riggs and Enochs [34].

The STEBI B Cronbach alpha values were 0.899 (PSTE) and 0.864 (STOE), with none of the items showing a corrected item total correlation value below 0.3 so no items were excluded. The alpha values obtained were again equivalent to those given by the STEBI B developers [11], indicating the results have validity.

The PSTE and STOE scale scores were calculated for each cohort at each sample period to track any changes that may occur over time. These scores were also interpreted in conjunction with the data collected during the semi-structured interviews.

Interviews were transcribed in full and common words and themes were identified, developing a coding system allowing for responses to be categorised [12]. The coded interviews were then examined at an individual and a group level.

Results

Changes in self-efficacy (STEBI)

The results from the STEBI surveys showed that self-efficacy was increased as a result of the workshops, and this increase was observable for at least 11 months after the workshops were completed.

The ACT in-service cohort showed the greatest gains in PSTE overall, increasing their mean scale score from 39.29 at period 1 to 48.57 at period 4. The pre-service teachers increased their mean PSTE scale score from 41.88 at period 1 to 47.38 at period 4 and the NSW in-service cohort increased from 45.17 at period 1 to 49.33 at period 4.

The STOE scores showed very little variation for both in-service cohorts (NSW and ACT) throughout the study, with the difference between their first and final mean STOE scale scores showing a decrease of 0.5. The pre- service cohort showed the greatest increase in their STOE scores over the study period; although this increase was not maintained once they were out teaching in schools when their mean STOE scale score returned to the same as that recorded in Period 1. The mean values of both scales in the STEBI instruments recorded in this study are comparable to those found in other larger Australian studies with in-service [8] and pre-service teachers [28].

Interview data–change in practice?

At both interviews, participants were asked if they had attended any other form of science based professional development (PD). Of the 21 participants, only Anita had heard of and attended any science PD. Thus, for the majority of participants, these workshops remained the only PD in science they had received in one year.

At the first interview held four months after the completion of the workshops, participants were asked how much science they were teaching in school. The majority of participants indicated that they were teaching less than one hour of science per week. Some of the key reasons identified were the structure of the curriculum at the time.

Despite limited opportunities to teach science on their practicum, some of the pre-service participants identified that they had already used the workshop activities in their future lesson plans:

I've written the next [science] unit…I used the activities from your physics workshop (Kendra, pre-service)

Other pre-service participants continued to find the activities useful beyond their teacher training, using them and sharing them with colleagues once they were employed in school:

…this term we are doing weather. All the activities you gave me on the …workshop…I've shared [them] with the other teachers as well (Jaeda, pre-service)

For some in-service participants, the requirements of their job—particularly if they had moved to a more administrative role—meant they did not teach much science. However the workshops were still considered useful:

…Had I been on class, I'd have done more science. I'd have leaned fairly heavily on [the workshops] (Brian, ACT in-service).

At the second interview, conducted 11 months after completion of the workshops, three of the eight pre-service teachers were teaching more than one hour of science per week. While the amount of time spent on science stayed the same for the other participants, many reported adding more activities from the workshops into their science programs.

The greatest differences in results were observed between the in-service participant cohorts. The ACT cohort had the support of the principal, and the deputy vice-principal was a participant. Science appeared to be valued in the school. The same results were not observed in the NSW in-service cohort, who continued to cite time and a lack of resources as barriers to their science teaching. Science did not appear to be valued in the same way as in the ACT school, and none of the school leadership team participated in the workshops. The ACT in-service participants supported each other through the process, as described by Brian:

…[the workshops] gave an impetus to the seven of us who did it without which we…would be more backing off from science than turned out to be the case, given the fact that you did this with us.

Two of the NSW participants, Anita and Simone, changed schools in between periods 3 and 4. Their comments provided some insight into the environment of the participating NSW school. Anita was quite direct "it's all good, I'm not at [the former] school anymore!"

Simone believes the low status attributed to science is endemic to teachers generally:

…That's how I see this new school, it's no different to the motivation [to teach science] at [the old school], it's exactly the same…they don't see science as a big priority which is something that we have to change…that in the teaching culture, particularly in primary school…every school I have taught at in the last 20 years is exactly the same…you have to change that whole teacher mentality on it actually.

A role for science centres?

All participants agreed that there was a role for science centres within the formal education sphere; three main functions were identified. The first was as a source of information/resources and ideas. Most asked for a prescriptive kit or a book of ideas. Both Lorraine (ACT in-service) and Jaeda (pre-service) wanted more activities like the workshops, as they liked how they were explained and the equipment was easy. A frequently occurring comment from all participants was that of science centres having expert knowledge which the teachers could use to help them teach science.

The second role identified was that of a motivator. This still had a resource and ideas element attached to it, but a key defining factor was the human resource to "inspire you to do [science]" (Kerrie, ACT in-service). Brian noted that the workshops had done that for the ACT participants; they had all experienced that "'eureka' feeling".

The third and final identified role was that as a trainer or professional development provider. This was especially apparent in the comments made by the pre-service participants who felt that the workshops contributed to their training and development as teachers. Sam described the workshops as the "first actual, interactive, useful experiments that I have had as a teacher". This was supported by another pre-service participant, Kate:

Run more workshops - please! Seriously, the unis are failing to provide proper science units and we're just going to have this generation of teachers that are…just not going to teach science…If I…hadn't done the workshops that you did I doubt that I'd be teaching science.

In-service participants also supported the idea of science centres as training providers. Paula reiterated the perception of science centres as experts, stating that science centres could and should be used by Australian state and territory education departments for curriculum development and supporting resources.

Discussion and Conclusions

The results obtained in this study showed that the science teaching self-efficacy beliefs of both pre-service and in-service teachers were positively influenced by science centre style professional development workshops. The increase in self-efficacy was still apparent 11 months after the completion of the workshops. The results are comparable to those presented in a study of the impacts on science teaching self-efficacy of a 13 week science methods course in university [28].

For four, one hour workshops to achieve the same increases in science teaching self-efficacy as a 13 week university course, this indicates that the efficiency of short term professional development—especially that provided by ISIs—should not be dismissed. This is supported by Desimone et al. who did not find any significant relationship between the duration of professional development undertaken by teachers and the subsequent learning outcomes of their students [10]. Perera similarly found that a one day workshop using constructivist principles, like those employed in these workshops, were capable of facilitating teachers' conceptual change [30].

The ACT in-service cohort showed the greatest gain in PSTE overall, followed by the pre-service and then NSW in-service cohorts. The main difference between the pre-service and in-service cohorts was seen in the STOE scale. The in-service cohorts showed very little change throughout the study period, whereas the pre-service cohort showed consistent gains until they were out teaching in schools when their mean STOE score dropped back to its original level. This could be attributed to their realisation of what they could actually achieve once they were out teaching in classrooms, as opposed to the first three sample periods when their outcome expectancy was largely based on assumptions.

The ACT in-service cohort showed greater gains in their science teaching self-efficacy in comparison to the NSW in-service cohort. The ACT cohort was supportive of science and each other, as shown through their interviews. This collegial support was important in sustaining their increased self efficacy, a conclusion supported by the similar findings of Penlington [29]. The comments of some of the NSW participants indicated that the low status afforded to science as a subject area, and of teachers' reluctance to teach science, is common in many schools. This indicates a need for reform efforts to target attitudes of teachers.

Constructivist approaches can facilitate conceptual change [30]. This is required as "unless there is total commitment of all staff to new ways of working, reform efforts soon falter" [35:p12]. This too highlights the importance of examining the context of teachers' beliefs, as the context may have greater influence than other demographic variables [40,21,23]. The school environment may be the greatest limiting factor to science education reform.

The participants perceived science centres, and other ISIs, as experts in their field. This is supported in the literature [12], and echoes the use of 'outside experts' as preferred providers of professional development [4]. The participants of this study believed that science centres are capable of providing resources, motivation and training to teachers. The results of this study show science centres can indeed be effective trainers and PD providers. Even with a short investment of time and resources, these positive impacts can be maintained for at least 11 months, particularly when they occur within a school environment that is supportive of science. These results show that science centres, and other ISIs could help enhance science education as they are capable of engaging and motivating reluctant science teachers. This is a valuable finding for an area of research that has little documented evidence of impact in teacher PD [3]. It also signifies a potential way forward to achieve science education reform.

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165. Discussion on the Social Role of Science and Technology Museum

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Abstract. At present, public demand for science popularization is getting higher and higher. As an important national science popularization infrastructure, Science and technology museum are facing unprecedented opportunities and challenges. To meet the requirements of the times, continuously strive to raise the standards of our works, and achieve sustainable development, we must accurately locate their social role.

Firstly, this paper analyses the goals, features and functions of Science and technology museum. Then, this paper turns to explore the social role of Science and technology museum. In general, Science and technology museum should be located multiple roles.

Keywords: Science and technology museum, Science popularization, Social role

Introduction

With the social progress, public demand for science popularization is getting higher and higher. Science popularization has turned into a demand for adapting to the modern society and promoting life quality for public, as well as an important foundation of improving the scientific literacy. Science and technology museum are a kind of public- benefit facility serving for the members of the society. At the same time, they are an important platform to advocate scientific approaches, propagate scientific ideas, promote scientific spirit and disseminate scientific knowledge.

Since 1980s, Science and technology museum in China, not only the quantity, but also the scale of construction, have been rapidly developed. However, some new problems have appeared. For example, many museums lack of characteristic, their educational content and style are drab, the management is not enough reasonable, and so on. We can't just seek expansion of the scale, and we should make more positive change, improve the education level and develop our own characteristics, so as to meet the requirements of the times and achieve sustainable development.

The Goals, Features and Functions of Science and Technology Museum

o locate the social role of Science and technology museum, we should understand the goals, features and functions of Science and technology museum firstly. Then on this basis, the model and opinion can be presented.

The goals of science and technology museum

As an informal educational institution, Science and technology museum disseminate scientific and technical knowledge to the public by various activities. Far more important, they promote the public to understand science and technology, learn scientific and technical methods, share scientific spirit and improve the scientific literacy during this process.

The features of science and technology museum

Science and technology museum are a social cultural and educational institution, and they obviously different from other educational institutions.

Firstly, they are open. This openness reveals in every way. For example, their educational objects are all social members, their demonstrations are multidisciplinary and multifactor, and their educational patterns is flexible.

Secondly, they are participatory. The public can actively get involved, and develop their knowledge structures in the course of participating. Science and technology museum put emphasis on subjectivity of the public. They are public-oriented and strive to meet the public's needs.

Thirdly, Science and technology museum are situational. Their essence is that they build an explorations and discovery atmosphere for the public by simulating.

Fourthly, though the education of Science and technology museum is an informal education, it is intentional or planned. It has advanced educational notion, rich educational resources, and comprehensive and multi-layered educational activities.

Finally, they are scientific and interesting. Science and technology museum put emphasis on scientificity because they aim at propagating scientific knowledge and transmitting scientific information. At the same time, to gain the interest and attention of the public, keeping their interesting in education is also essential.

The functions of science and technology museum

Science and technology museum have three basic functions, some are similar to the functions of other science popularization educational institutions, but others are unique.

The first is educational function. This is the primary functions of Science and technology museum. Through such exhibitions as permanent exhibition, thematic exhibition and short-term exhibition, and diversified educational activities (for example, scientific experiments and science popularization lectures), Science and technology museum could reveal the secrets in science, develop the interest of the public in science, explore scientific methods and promote scientific spirit.

The second is service function. It provides a service for implementation of education function and development of Science and technology museum. This includes: providing information and resources about science popularization exhibition, holding training and academic exchanges for schools and other educational institutions.

The third is support function. It is used as a support for Science and technology museum to evaluate their educational function, service function and operation administration, resources development for exhibition and education, as well as deeply study for information and theory about Science and technology museum [1], so that the educational content can be more substantial and keep up with the new times.

The Social Role of Science and Technology Museum

"Care for people, service society" is the starting point and foothold for museums to implement various work. The social function and the own characterized advantages assumed by museums determine that there is no shirking the responsibility for museums to be the indispensable link and multiple roles in the current society. According to the educational function, Science and technology museum should be the disseminator of scientific knowledge, the guide of scientific

Figure 1. Functions of science and technology museum

interests and scientific concepts and the communicator between the public and the scientists. According to the service function, they should be the partner and supporter of other educational institutions. And according to the support function, they should also be the researcher on education and related theories of Science and technology museum and the collector and the performer of the historical collections.

The disseminator of scientific knowledge

It is one of the basic functions of Science and technology museum to popularize scientific knowledge and it can also absorb a wider range of educate without the limitation of age, education background and careers in order to provide fairer education opportunities for the backwards areas and the vulnerable groups [2]. Therefore, Science and technology museum have naturally become the disseminator of scientific knowledge and the lifelong classroom for the public. Certainly, the way in which museums disseminate scientific knowledge is quite different from the past museums and other education systems in the education hierarchy. It creates a fascinating learn situation and practice place in various advanced ways and methods. Through displaying the scientific exhibits and the rich and colorful educational activities, it attracts the audience to participate in and makes them deepen their knowledge on the exhibits in an unstrained atmosphere in order to enter into the process of exploring and discovering the science.

The guide of scientific interests and scientific concepts

Currently, the target of education has been shifted from the single target of knowledge to 3D targets of "knowledge and skill", "process and method" and "emotion, attitude and value". Among the 3D targets, emotion, attitude and skill are the principal targets of education [3]. Therefore, the principal target of Science and technology museum is to promote the scientific spirits, to develop the scientific interests and to make the public establish the scientific world outlook, outlook on life, value and outlook on science and technology. Science and technology museum shall keep pace with the times and allow full play to own advantages. Through creating the learn situation and practice place, they give the public to experience science and apprehend science and stimulate the public interests of learning science; they propose that the public should continuously update scientific concepts in the keen learning atmosphere to develop scientific thoughts and scientific spirits and improve comprehensive quality. Therefore, on the basis of keeping enriching the connotation of exhibits, Science and technology museum can launch a series of activities of "scientific circus" and "scientific lab" to provide the public with precious opportunities to experience the funs and marvels of science, to anneal the ways and techniques of research and to know the scientific spirits of humanities and anecdotes in order to improve their interests and understanding of knowledge and master scientific methods and ideas.

The communicator between the public and the scientists

In the real society, education must be closely related to the social cultural activities and the practical life, so it gives more emphasis on the ability of the public to deal with the practical problems and to participate in the public affairs with scientific knowledge, which gives full play to the "scientific civil rights" of the public [4]. In the recent years, in order to set up the communicative bridge between science and technology and the society, and the scientific and technological workers and the public, as well as to develop the public sense of participation in science and technology and sense of responsibility of scientific and technological society, Science and technology museum have made constant efforts and trials to launch various communication activities on scientific and technological cultures in close cooperation with the social circles in order to make the public experience the charms of science and the elegance of the scientists at short range. For example, China Science and Technology Museum has held the activities of "I share my views on future with scientists", which is an activity the national teenagers participated in to share views on future with the famous scientists, "'Science and China' academician forum on 'Science Lecture' in China Science and Technology Museum", "Expert Volunteers" and so on. There have been many scientists flourishing on the stage of science popularizing in the museum. These activities not only promote the communication dialogues between the scientists and the public but also motivate the public to understand science, and also make museums the scientific and cultural activity center to the public and the platform to disseminate and communicate scientific cultures.

The partner and supporter of other educational institutions

Lengrand presented the educational thought of lifelong learning, which combines social education with school education and regular education with informal education tightly. As the social education place and informal education institution, Science and technology museum have formed an effective supplement and extension to schools and other educational institutions in many aspects of education aim, education objects, education content and education methods with their particular characteristics; Science and technology museum have accumulated many interesting medium and large scale scientific education appliances, so these scientific education resources and such scientific education place entitle students to feel and experience what the classroom teaching can not substitute. Meanwhile, Science and technology museum launch rich and colorful education activities through close cooperation with schools and thus they provide many kinds of service and supports for schools. For example, China Science and Technology Museum opens to the student group for free and provides an extracurricular activity place for schools; at the same time, it keeps strengthening contact and cooperation with middle and primary schools to launch "Jin Peng Lecture", "the Future Engineers" and a series of branded activities aiming at students in order to make students deepen their understanding and comprehension to science while participating and experiencing. Besides, it holds special training classes on scientific experiments for the science teachers in schools, which gives the teachers an opportunity to promote teaching level and broaden teaching thinking. Through various measures, teachers, students and Science and technology museum have established a close contact, and also Science and technology museum have become the base to assist schools and other regular educational institutions to reach education targets and train innovative talents.

The researcher on education and related theories of science and technology museum

Science and technology museum are not only the practitioner of science popularization education, but the researcher of education teaching. Developing academic researches and exploring the law of development, exhibition education theory, designing methods of exhibitions and exhibits and management system and mechanism of Science and technology museum, is helpful to establish the correct exhibition education theory and beneficial to develop Science and technology museum. Detailed and in-depth researches can continuously promote the level of Science and technology museum, support our high-level exhibition educational activities and timely reflect the latest research achievements in the exhibition education activities to make up the gap between educational theory and educational practice and improve effects of science popularization education. Up to now, China Science and Technology Museum has made and is making dozens of research topics, such as “National 863 Planning Topic”, “Study on Worksheet Development Based on Science and Technology Museum Resources”, and “Research on Engineering Education Based on Science and Technology Museum Resources”. Some of them have made great achievements.

The collector and performer of the historical collections

Science and technology museum are not only the accumulative treasury embodying the national and ethnological scientific and technological cultures, but also the main front inheriting the history of scientific culture. It has been pointed out in the Construction Standard of Science and Technology Museum made by the UNESCO that one of the three types of exhibits in Science and technology museum are historical collections (the originals and the replicas):”items related to developments of science and technology from ancient times to present and items collected and reserved for displaying the progress of science and technology home and abroad.” London Science Museum, National Air and Space Museum and many overseas reputable science museums all possess abundant of treasures which are strongly attractive to a great number of audiences. But in China, Science and technology museum do not have the function of collection. Therefore, this aspect shall be strengthened by collecting and displaying some precious historical collections, exploring the connotation of scientific culture behind and performing in various ways in order to coordinate exhibition and education and other purposes. In 2004, the Nation approved of giving the spacecraft Shenzhou 1 to China Science and Technology Museum for permanent collection, which is expected to be the moment for the national museum to expand the area of collection research in order to shorten the gap of scientific and industrial museums between our nation and the developed nations [5].

Conclusion

The social role of Science and technology museum shall be rich, active and developing. That what this paper illustrates are not all for it, and these social roles should be combined together or stressed on particular emphasis because of the demands of practical work of Science and technology museum. We must keep on researching, exploring and practising in order to be adapted to the demands of social developments and to better give play to its roles.

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166. Science Center is a Major Player in Science Communication in Industrialized Countries Rather than Developing: Reasons and Suggestions to Bridge the Gap

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Abstract. Science centers deliver natural ways of active playful learning to their visitors and let them experience hands-on-science. They have pushed the boundaries of informal science education by telling people something starting from their daily experiences. However, the educational role of science centers in society depends on what kinds of image of science are presented by science centers to their visitors and the public, and how those images are communicated. In developing countries, Science centers are not enabled to produce desired outputs or leave a strong influence on community of interest because of their weak mission, strategic plan and corporate structure. It is still challenging for science centers in those countries to throw a personal, social, political and economic impacts on community of interest. This is important to justify their value in communicating science to all age groups.

This paper aims to provide some reasons why science centers are not so effective in developing countries while diffusing widespread knowledge of science dramatically in industrialized countries. There are also some attempts suggested to bridge this gap.

Following aspects will be pointed out in the article.

1. Publicity through media
2. Socio-cultural diversity
3. Advanced visualization technologies
4. Interesting and interactive online activities on science center’s website
5. Learning science by amazing science live shows, movies, events, demonstrations, work.

Introduction

The perfect definition for a science center is that encourage you to experiment, touch, discover and explore. Science center is a grassroots effort to engage public to increase their understanding of the nature of science and its value to society. They provide long term learning by an opportunity to explore science in a family-friendly, comfortable environment.

In this new world citizens require more scientific information. Science centers have evolved in the last two centuries to become places of representation of that knowledge. Engaging visitors in a learning experience is a fundamental objective for science centers. But, the social and economic levels of science centers in the two groups of countries, developed and developing, has created a huge difference in learning strategy due to their difference of scientific and technological infrastructure and in the popularization of science and technology.

In developed countries science centers offer rich resources for lifelong learning, providing meeting places for citizens and the research community, supporting schools, and contributing to the cultural and economic vitality of their communities. While in many developed countries, science centers does not have enough resources to elaborate themselves because of financial problems, lack of public interest, less popularization of science, etc. There are some ways to bridge the gap of wide-ranging personal, social and economic impacts of science centers between both groups of countries.

Difference in following aspects of science centers between developed and developing countries

Publicity through media

In industrialized country for example United States, Every person is greatly aware of science center, their objectives, and benefits by participating in their programs and their value in this science and technology era. The reason for this awareness is number of hands-on-science centers in America which is above 100. Publicity of those science centers through media is the biggest reason behind their success story. They are easily accessible in each city so, public doesn't need to make a plan to go out or spend money on travelling. Every part of media as Newspaper, magazines, internet website, television, radio and advertising banners are deeply involved in helping people attracted to them.

There was an exhibition 'Mummies of the World', assembled in California science center was among the highest-ranked paid exhibits ever hosted by the Science Center. In its first 50 days, the exhibition welcomed 100,000 visitors. This could be the biggest example for the evidence of public attraction by publicity.

What happens in developing countries? There are 13 countries in South America but there is only one hands on science center among 13 countries which is in Argentina or one or two science museums. People in remote areas never visit science centers and disconnected to science and technology. They often have no interest in visiting the science center, either because of economic difficulties or because they do not feel a clear connection between science and their daily lives. We must make a special effort to carry relevant messages directly to these populations.

In order to create strong public value, science centers must be able to relate to their communities and understand their realities. They need to cultivate the ability to attract diverse audiences or bring relevant programming directly into communities. In this way, centers can empower individuals to participate actively in learning, knowledge, and innovation processes. For example, In Maloka Cycle Science program, performed on cycles due to no road or land access. Maloka's bicycles carry hands-on activities and are fitted with posters that contain information on science and technology [4]. The public can learn about a diverse range of topics and make close connections between science, technology, and their everyday lives. Activities are designed to answer questions about exercising, such as: Why do I sweat? What do I need to eat to be healthy? How do skaters perform their maneuvers without falling down? For that, skaters were invited to do demonstrations and created hands-on activities that explained the physics of their movements. On an average Sunday, they engage 500 people in activities, and more than 10,000 people can see a different face of Maloka in the streets.

The popularization of science helps to enhance personal satisfaction, self-esteem in the population. Scientific journalists and communicators play a major role in increasing public awareness of science. It was observed that governments, international organizations and relevant professional institutions should enhance or develop programs for their training. National authorities and funding institutions should promote the role of science museums and centers as important elements in public education in science.

Socio-cultural diversity

There are significant social and economic differences between developed and developing countries. Many of the underlying causes of these differences are rooted in the long history of development of such nations and include social, cultural and economic variables, historical and political elements, international relations, geographical factors.

Being born into a racial majority group with high levels of economic and social resources—or into a group that has historically been marginalized with low levels of economic and social resources—results in very different lived experiences that include unequal learning opportunities, challenges, and potential risks for learning and development.

"The Learning Sciences have not yet adequately addressed the ways that culture is integral to learning. By "culture," we mean the constellations of practices historically developed and dynamically shaped by communities in order to accomplish the purposes they value, including the tools they use, the social networks with which they are connected, the ways they organize joint activity, the discourses they use and value (i.e., specific ways of conceptualizing, representing, evaluating and engaging with the world). and other front line educators should actively integrate into science learning experiences, questions, everyday language, ideas, concerns, world views, and histories, both their own and those of diverse learners.

Advanced visualization technologies

Children enjoy active and informal learning rather than a class room education. Science Centers offer challenging exhibits that enable their visitors to experience hands-on science by actively manipulating the experiments, thus delivering natural ways of active playful learning. Science centers provide perfect educative environment to children as well as adults.

Developed countries have been successful by using the power of advancement in stimulating interest and increase understanding of the sciences. Advanced visualization technologies are often used to enrich enjoyment, inspiration and creativity in public. Science Centers in developed countries brings together experts in science education, computer science and pedagogical evaluators in order to support science education. Science movies put you in the center of the action by projecting breathtaking quality images.

In 2003 "The California Science Center hosted OCEANFEST 2003, a fun film-going event that gave people an opportunity to learn about, experience and truly become part of the ocean habitat and its ecosystem that we all depend on across the world. The film festival had giant-screen documentaries that captured the thrill of ocean exploration, revealed the astounding diversity of life beneath the sea and sparked a deeper appreciation of how the ocean affects all of planet earth.

In movies, Coral Reef Adventure and Volcanoes of the Deep Sea, as well as the always popular hits Dolphins and The Living Sea, the public got a chance to dive into the latest scientific knowledge about the sea that truly brought science to life with an unforgettable view and eye-popping underwater scenery. Combining great storytelling and innovative photography, these films not only have a sense of adventure but create an emotional impact that can bring people closer to nature than they ever imagined. They were one of the most technically advanced underwater films.

Many developing countries are emerging with advanced science technologies but still they have a long way to go. Developing countries should be committed to retaining high-level scientists, stimulating them, and providing funds and other support to encourage and maintain their productivity. Therefore, enhancing chances to get good quality of work and growth of social and economic levels. Further to make education enriched with advanced techniques and comparable to the quality of science in developed countries.

Interesting and interactive online activities on science center's website

Online Activities are an extension of the great fun and educational experiences of the world of science without leaving home.

In industrialized countries everyone does have access to internet. That way, they have more chances to learn science. In their websites, they choose topics related to everyday life and make it easy to understand by videos therefore, become a part of our store of long-term memories.

The basic knowledge about all scientific areas that everyone should have, is now accessible through internet. For example, http://www.cosi.org/visitors/online-activities/. This site has free videos for open heart surgery, knee surgery, how a farm is maintained, road rules and regulations etc. These online interactions have always been successful to create interest in students, increase their creativity, help them in augmenting their natural exploratory skills, innovative thoughts and make them choose a better career they like.

Science centers offer online interactive science quizzes for both kids and adults. Like, http://www.explorit.org/ science.html. It has quizzes around all areas of science such as, astronomy, space, biology, chemistry, physics, weather, water, medical and math. Moreover, they have online challenges, stumpers on many topics, human body experiments like Bones and Muscles; Heart and Circulatory System; Senses and Nervous System; Lungs and Respiratory System; Digestive System; Immune System.

In many developing countries, there is rare access to internet due to lack of science and technology development or economic problems. The social and economic growth of the developed countries is dependent on an essential emphasis on education, science, and technology. The basic problems of developing countries are the weak educational and scientific infrastructure, and a lack of appreciation of the importance of science as an essential ingredient of economical and social development.

Science and technology have been given neither the urgency nor the priority they deserve in international aid. The solution is to focus on expanding the use of new sciences and technology in developing countries. With support from rich countries investments must be made in areas of particular interest to developing countries, such as education, research and technology. National policies should emphasize on all the supports for popularization of science as internet which is indispensable technology for public awareness towards science.

Learning science by amazing science live shows, movies, events, demonstrations, workshops

Awareness for science is on higher level in industrialized countries, and public know that the investment in science sector is coming back with a huge benefit in the form of bright future of children and growth of technology which is basic requirement for the social and economic growth of each country. Government and big industrialist or investors are always ready to finance for science centers. This money is used to make learning more meaningful and more understandable by using new techniques. Qualified persons are hired for science demonstrations, events and shows. High level scientist conduct exciting educational programs and presentations on a variety of hair-raising, mind-boggling, and eye-catching topics such as the human body, music, space and more. Live, interactive stage shows bring science to life!

Science Center presenters demonstrate the wonders of scientific phenomena from the stage and invite audiences to ask questions and help with the presentation. Numerous studies of visitor's conversations during or immediately after science center visits have shown evidence of visitors extending and enriching their conceptual understanding.

Some science centers provide inquiry based learning that help students achieve standards-driven understanding by expressing their natural curiosity as they pursue personal questions to explain how the world works. Research suggests that this approach enhances meaningful understanding of science content and also helps create a passion for life long learning. The Inquiry approach holds great promise for significantly improving student performance because it helps students to become active and sometimes passionate learners. Students develop a deeper understanding of the world around them and are encouraged to communicate and discuss their knowledge.

Live Science Shows present science to the public with all the grandeur of tricks, theatrics, and wonder that are sure to enlighten and entertain people of all ages. Science is about doing – seeing concepts unveil themselves right in front of you.

Figure 6. Electrifying show

Like- In Detroit science center an electrifying experience is enough to prove the learning importance in science centers that make your hair literally stand on end. Their "spark-tacular" performances demonstrate how electricity affects the world, and how electricity and magnetism interact with matter. Thousands of volts are generated during every demonstration. The whole space is built within a Faraday cage, which keeps electromagnetic waves under control and ensures the safety of other activities throughout the Science Center.

In California science center 'Mummies of the World', live show was organized. It had collection of both accidental and intentionally preserved mummies. The collection included ancient mummies and important artifacts from Asia, Oceania, South America and Europe as well as ancient Egypt, dating as far back as 6,500 years. The exhibit revealed how the scientific study of mummies provides a window into the lives of ancient peoples from every region of the world.

Figure 8. A mummy showed in the show

Figure 9. A mummy showed in the show

Figure 10. A mummy showed in the show

In developing countries, Public really does not seem interested to visit science centers because they do not know the benefits of informal learning rather believe in classroom education, besides they have no timely access to programs or events go on in science centers. The reason is because of no publicity, no internet access. Further more, in some countries, there is none of science centers and other have too less in number, or too far from other cities which does not have them. Therefore, transportation problem, expenses on travel diminishes the excitement and curiosity to visit science centers.

In those areas school field trips to science centers should be organized. Teachers should encourage students to participate and interact to science activities offered by science centers. Teachers are ideal for students, they should use their belief on them and direct in gaining skills and developing positive attitudes toward the subject matter. They should help students in acquiring enthusiasm, exploration and new conceptual understanding considerably faster than they could in the classroom.

There should be some government programs under which poor students do not have to pay the fees; some scholarships should be awarded to children for participating and showing their creativity. These are some ways to encourage children in achieving better goals in life and joining the new world of science and technology reaching to high levels in developed countries.

Conclusion

In summary, science centers have proved themselves as an essential part of informal learning for students or adults. Developing countries need to do better in educating people in science and technology via fulfilling some basic demands of popularization of science centers.

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167. Learning Mathematics Through Video Games: A Study Among School Children

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Abstract. A video game is an electronic game that involves interaction with a user interface to generate visual feedback on a video device. It becomes one of the dominant forms of electronic entertainment, both for adults and children around the world. The use of multimedia in education has significantly changed people’s learning processes. This study investigated whether computer-based video games facilitate children to learn and understand mathematics. Results from a number of research studies indicate that appropriately designed multimedia instruction enhances students’ learning performance in science, mathematics, and literacy. Computer-based video game playing not only improves participants’ fact/recall processes but also promotes problem-solving skills by recognizing multiple solutions for problems. The result shows that the computer games could assist preschool children’s learning of mathematical addition, this phenomenon might be related to children’s active attention toward repeatedly solving mathematical addition questions. While playing, both boys and girls could sustain their attention toward playing the games, and, in turn, they actively could learn the content.

168. Mobile Technology Application in Science and Technology Museum

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Abstract. Information technology innovation enriches public communication methods of science and technology. This has been verified by inventions of personal computer, Internet and Web 2.0 in the past. Mobile technology has been used in more and more areas and it makes location-based information services by different mobile devices possible. This article investigates the opportunities and challenges for science and technology museum brought by mobile technology. It discusses typical scenarios from public visitors’ and museum management’s view. Examples of China Science and Technology Museum are also shown.

IV

Science Communication through Mass Media

169. Science News Coverage and Its Impact on Readers: A Study of Science Popularization through Newspapers in Uttarakhand

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Abstract: Though the media is doing some what good to disseminate the science but media alone is not capable to make the public aware about the science. The very reason behind this fact is that the most of the reader are not convinced why to read the science news? That is the reason where science communication gets paralyzed as far as science popularization through news papers or print media is concerned. This theory is based on a study conducted under 'Rajat Jayanti Vigyan Sancharak Fellowship-2009' in uttarakhand. For this purpose six most circulated news papers were chosen for content analysis while a preliminary survey of the study field was conducted to know the actual position of popularity and impact of science news. In this research paper science coverage by the news papers have been discussed in details as their presentation, terminology, follow up etc.

Keywords: Science communication, Print media, Presentation, News papers, Content analysis, Terminology

Introduction

The founding Fathers of the Indian republic gave great importance to the cultivation of a `scientific temper' by incorporating it in the Constitution. Under article 51(a) in Fundamental Duties it is clearly mentioned that it shall be the duty of every citizen of India to develop the scientific temper and sprit of inquiry. These duties are obligatory for a citizen. In our constitution media does not have any specific privilege other than a citizen of India, so the media is also liable to follow same duties as per the citizen of India has. But instead of this, Media's sensationalism approach, illogical and unscientific thoughts are prevailing in the society and particularly in the new generation. That's why besides being adhere to the scientific notions and logics, this new generation is having distance from it. Even 'National Knowledge Commission' on May 2008, in its report tabled before Prime Minister of India grieved over the fact that the percentage of science students is declining continuously. In its report commission further elaborates that the interest of students for science, as a subject in college level, is diverting.

Because science and technology is the fundamental to the society for its growth and development but there is still a considerable gap between science community and society. The Scientists engaged in their researches, write their findings in the scientific language, which is not to be understand by a common man. As we know that the media are key shapers of public opinion, the more effective communication to the public is increasingly necessary for the scientific community. But without media support this goal remains out of sight. Writing about science journalism in his book 'The Wisdom of Science', R. Hanbury Brown has moaned "Although advances in science and technology have given us an unparalleled ability to communicate with one another by radio, television and vast quantities of print, these so-called 'media' are seldom used to tell us anything about science…." On the other hand Dr. Jayant V. Narlikar says that the astrological forecasts appear regularly in our newspapers but science and technology is touched if at all, only with a bargepole. Newspapers play a vital role in spreading information and opinion in times of stress. In the present age of science they should not treat science journalism as quiet backwaters. They should look upon it as an ocean vibrant with waves and tides that affect our destiny.

Directorate-General for Research of the European Commission analyzed those points due to which science cannot get space in media. In its findings commission says that although the media see information from the scientific community as of high importance, they find this information to be complex and difficult to understand and consequently it is more difficult to use in a highly time-pressured environment. Due to these complexities media cannot take the message of science to the masses.

The problem is that the science issues hardly can arrange a space in media among the social, political, sensational, glamour and murder mysteries. Media players do not also think general science to be such hottest and burning topic which can bring for them a good readership. Irony is that, whenever new discoveries and any happenings take place in our surroundings, then only science is needed by the media. While on the other hand superstitions, astrology, fashion, glamour, sensationalism etc. are enforced in the society by the media. Though the media covers science issues occasionally but even the intention behind these stories is not to spread the very basic concept of science and its impact, rather to create illusion in the public. A most common news broadcast by news channels time and again is sufficient to proof this hypothesis. On 11th of May 2008, Sunday at 9.30 pm, renowned news channel started telecast a special story on the life of earth under the title of 'Dharti Ke Bas Char Saal'. In this news story it was said that on 21st Dec. 2012, the whole earth would be engulfed by the Sun. Since then many channels have broadcast the same story many times whenever they feel empty. Though everybody knew that it was totally illogical but even news channel got its theory endorsed by the version of D.U. Professor R.P. Tandon. This shows the sincerity of media for the science and society. We know that the media either print or electronic, are the only tools which can make the common people aware about the happenings. For this purpose follow up of any news story can play a vital role to make an undying impression in the mind of public.

Objectives

It is well known fact that the newspapers not only inform public about new scientific finding but also provides a lot of literature to enhance their knowledge. That's why for this purpose the coverage of science issues in print media becomes needed. Because the purpose of science coverage in media is solved only when even a layman can understand basic concepts of science which we want to disseminate. We know that the science and technology play a lead role in development of man and its society. All the facilities and prosperity in our life is the blessings of science. That's why it becomes mandatory to know the public attitude towards scientific aptitude. Because science is the backbone of all the developments, it is the duty of science community as well as media personnel to join hand for the sake of development. The present study aims to assess the role of newspapers in science popularization in Uttarakhand State. This study will assess present status of science news as how many newspapers do focus on science news and the popularity of science news among the masses. The following objectives are developed to conduct the study.

1. To study the present status of science news in newspapers.
2. To assess the popularity of science news published through newspapers.
3. To find out the actual position as space, placing and terminology of science news in newspapers.

Methodology

Science communication is an investment in human resource development as it plays key role in advancing human prosperity. This study will assess the role of newspapers in bringing awareness, arousing curiosity, creating interest, persuading and educating people for their betterment. In this study six most circulated newspapers (four hindi and two english) in Uttarakhand were taken for the content analysis. These are as Amar ujala, Dainik Jagran, Hindustan, Rashtriaya Sahara, The Pioneer and Garhwal post. As far as the coverage of science news through these newspapers is concerned, science news was categories into eight parts viz Environment, Health, Information Technology, Science & Society, Astronomy, Wild Life, Science & Technology and Miscellaneous. To know the actual position of science coverage, its utility and the taste of the readers, questionnaire was developed in such a way that the recent science related news could be included. For the testing of questionnaire or schedule a pilot surveys was conducted in Uttarakhand. Readers were asked about only latest science news coverage through print media. During the pilot survey readers were interviewed personally about their media habits and the taste of science news reading. In this study total 84 newspapers (six newspapers from 5-11 June and the same six newspapers 5 – 11 August) were evaluated during this period. To know the impact of science news on the masses 30 people were interviewed.

Results and Analysis

The collected data were analyzed and the results are shown as follows:

Table 1 shows the percentage of science news published in different newspapers. This shows that only Garhwal Post (English daily) give the more importance to science news. Though most of the science news are taken from agencies yet it published science items often regularly. Amar Ujala which is the most circulated newspaper of Uttarakhand does not give much attention to the science news.

Table 1. Percentage of science news published by all six newspapers

News Papers	Science news coverage (sq.cm.)	Total news coverage (sq.cm.)	% of science news
Amar Ujala	8573.5	288630.5	2.97
Dainik Jagran	12263.75	299018	4.10
Hindustan	17961	303864	5.91
Rashtriya Sahara	30372.25	369176	8.22
The Pioneer	16624.75	343866.75	4.83
Garhwal Post	20281.25	173611	11.68

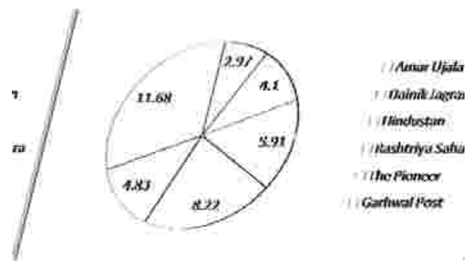

Figure 1. News paper wise distribution of science news in percentage.

Table 2 shows the category wise percentage of science news that were published by newspapers. This shows that though only 6% space is given to science news as whole but the environment is always on the top priority of newspapers. Though health is not less desirable topic by the media but the science and technology is lagging behind more with mere 2 percent.

Table 2. Category wise percentage of science news published in all the news papers

Category of science news	Size (sq. cm.)	Total Coverage of science news sq.cm.)	% (Category wise)	Total News coverage (sq.cm.)	% of science news
Environment	35690.5		33.10		
Health	32509.5		30.15		
Information Technology	5643		5.23		
Science & Society	5984.25		5.55		
Space Science	4595.5	107822	4.26	1778166.25	6.06
Wild Life	6504.25		6.03		
Science & Technology	2896.75		2.69		
Miscellaneous	13998.25		12.98		
Total	107822				

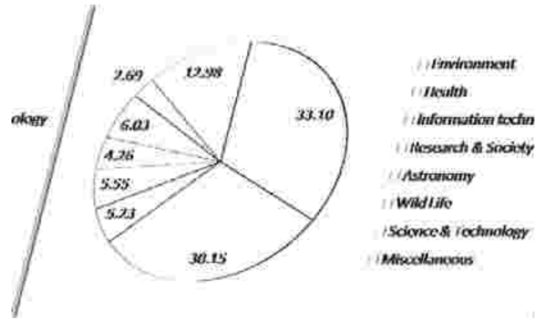

Figure 2. Category wise percentage of science news published in all the news papers.

Table 3 shows that newspapers do not give science news an important placing also. Out of all 441 science stories or items only 14 science news were placed in front page while 74 were placed on the last page. It is also clear from the table that Rashtriya Sahara gives more emphasis to science news as far as its presentation and placing is concerned. On the last page it placed 43 news items while Amar Ujala, The Pioneer and Garhwal Post did not placed any science news item on the last page.

Table 3. Placing of science news items in different newspapers

	News Paper	No. of total news	No. of front page news	No. of last page news
1	Amar Ujala	56	1	0
2	Dainik Jagran	63	5	7
3	Hindustan	82	2	24
4	Rashtriya Sahara	121	2	43
5	The Pioneer	60	4	0
6	Garhwa Post	59	0	0

Qno. Do you read science news regularly?

On the above question, 46.66 % readers said that they did not read science news while only 20% readers said that they read science news regularly. It was found that only graduate males showed their interest in science news. 33.33% of readers said that they read science news only if it has direct concern with their daily life such as medical, new technology etc.

Qno. Should newspapers give more space to science news?

On this question 73.33% readers want that newspapers should give more space while only 26.66% readers do not think it to be important. Though the most of the readers think that science is essential for everybody but the irony is that the most of the readers are not interested in science news reading as shown in table 4.

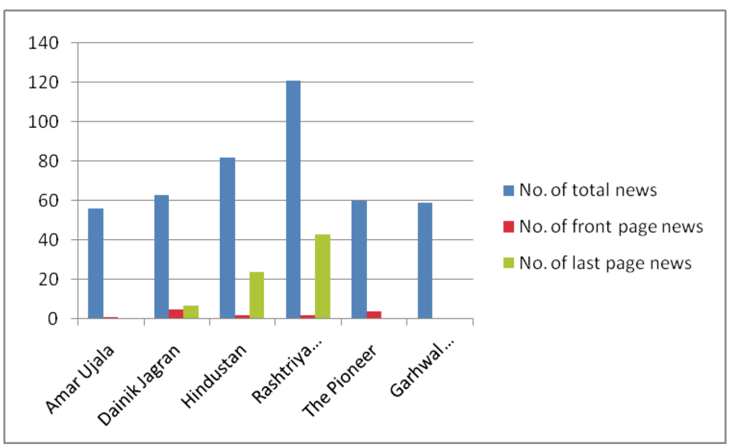

Figure 3. No. of science news items placed in either front page or last page as per the preference of news papers.

Table 4. Response of the readers about their science news reading habits

No. of total respondents	Reads occasionally	Yes	No
30	10	6	14

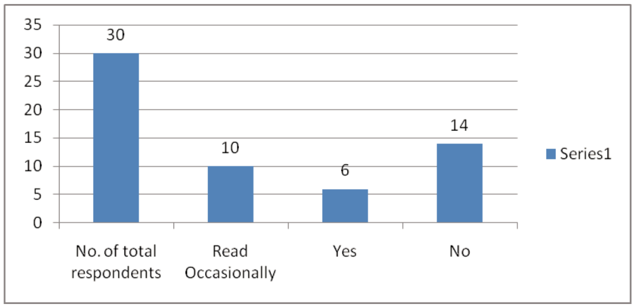

Figure 4. Response of the readers about their science news reading habits.

Table 5. Readers' attitude about the science news

No. of Respondents	Yes	
No		

30 22
8

Qno. What type of problem/s do you face while reading science news?

This questions shows that most of the readers do face problems in terminologies used in newspapers. 20% readers said that the understanding of science is a problem itself while 16.66% readers think that the big problem is with the way of science writing. 23.33% of readers think that the presentation of science news is not such that reader can attract easily.

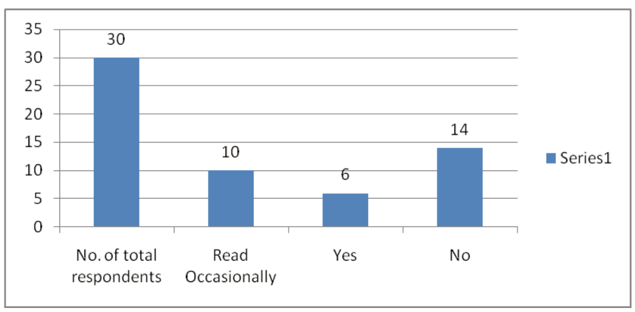

Figure 5. Readers' attitude about the science news

Table 6. Types of problems while reading newspapers.

No. of respondents	Understanding science	Terminology	Presentation of science news	Uninterested way of Science news writing	None

30 6 8 7
5 4

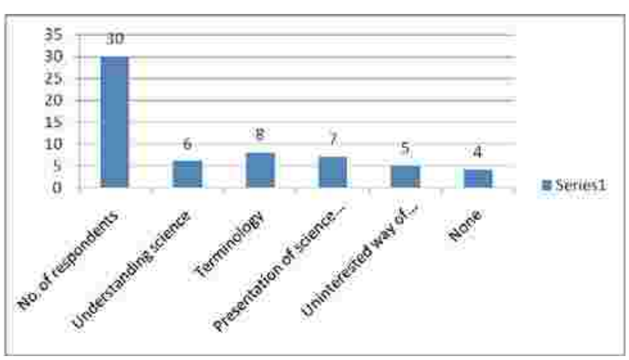

Figure 6. Types of problems while reading science news

Conclusion

The result of this study shows that the coverage of science news through newspapers is at the bottom. Only 6% coverage of science news is not such that can attract the most readers easily. During the analysis it was found that in these 84 newspapers only 441 science news items were published. As far as the space is concerned, in these newspapers the total space given to all types of news items was 1778166.25 cm. square, while the total space given to science news was 107822 cm. square only, which shows that only 6.06% space is being given to science related news. The scientific terminology used in the newspapers was found beyond the access of common mind. These terminologies such as Hydraulic, Deforestation, Inorganic, Oxidized, Metabolic, Climate Change, Biotechnology and many more were not made clear for the common reader. In the preliminary field survey of the State shows that most of the people do not prefer to read science related news. The most astonishing fact of the study came to know that availability of the newspapers in the villages is almost negligible. In rural areas, most of the villagers do not prefer to subscribe any newspaper. Instead of this they prefer to read the newspaper in the local market belong to that area. It shows that the dependency on newspapers alone is not the permanent solution. It means we have to adopt some parallel tools of communication along with the media to make people known about the relevancy of the science.

Acknowledgements

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170. Role of Media in Effective Communication for Energy Conservation: A Case Study of Guwahati City

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Abstract. This paper is aimed to review communication activities of the energy producers and suppliers of Assam for energy conservation. The study also tries to find out the consumers or energy users perception on energy conservation, their media habits. The report aims to discuss that most suitable media for energy conservation, which have maximum reach and impact to make aware and conscious the energy consumers and enhance their energy conservation habits. The paper is presented on the basis of all the data collected through interviews with the selected respondents of Guwahati city and officials of government of Assam agencies related to energy production, supply and conservation.

Keywords: Energy conservation, Awareness, Communication, Media habits, Conservation habit

Introduction

Energy conservation refers to actively reducing the amount of energy used, or making sure it is used as efficiently as possible. Energy means the ability to do something like warming something, moving something and lighting something. Energy conservation is meant to reduce the amount of energy being used. Energy conservation can be achieved through efficient energy use, in which case energy use is decreased while achieving a similar outcome, or reduction in the amount of energy consumed in a process or system or by an organization or society, through economy, elimination of waste and rational use.

Energy conservation has emerging as major issue in the country as the demand is increasing in a very rapid rate, which is also expected to be more than double 2030. There is a continuous gap between demand and supply of energy. Conservation and efficient utilization of energy of resources play a vital role in narrowing the gap between demand and supply of energy. Energy conservation also helps to save precious fossil fuel like coal, gas, oil which is used by the generating organization to generate electricity. Also reduction of use of fossil fuel leads to reduction of emission of harmful to gasses into the atmosphere.

While using energy, a considerable amount of energy is wasted. Therefore, conservation is an extreme necessity in present time reduce wastage and consumption which is possible only making aware and conscious the energy users or consumers. The use of communication strategies and techniques in order to disseminate methods and ways of energy conservation and convince people to adopt an energy saving behaviour has been recognized significantly.

To encourage and promote the efficient use energy, the Government of India (GOI) has enacted the Energy Conservation Act 2001 ('EC Act') and has established the Bureau of Energy Efficiency (BEE) in the Ministry of Power as the Nodal Central Government agency responsible for spearheading the improvement of energy efficiency through a combination of regulatory and promotional programmes. The Act recognizes the need for a strong and vigorous decentralized approach at the state level and provides for the establishment of state energy conservation agencies to plan and execute these programmes. It is a long and arduous strategic task to keep promoting energy conservation in the course of the country's economic and social development.

What is Energy Conservation

"Energy conservation" can mean a variety of things; the most common meanings are:

- using less energy in a particular application
- finding the ways to purchase particular forms of energy at lower cost. This is usually accomplished by negotiating with energy providers or by using energy under less costly conditions.
- shifting to different energy sources of lower price
- using "free" or "renewable" energy sources
- conserving water and materials, as well as energy sources. (Donald R. Wulfinghoff)

Why Conservation Energy Requires

- People uses energy faster than it can be produced. Coal, oil and natural gas - the most utilized sources take thousands of years for formation.
- Energy resources are limited. India has approximately 1% of world's energy resources but it has 16% of world population.
- Most of the energy sources cannot be reused and renewed. Non renewable energy sources constitute 80% of the fuel use. It is said that the energy resources may last only for another 40 years or so.
- The citizen save the country a lot of money when they save energy. About 75 percent of the country's crude oil needs are met from imports which would cost about Rs 1,50,000 crores a year.
- Energy saved is energy generated. When a person saves one unit of energy, it is equivalent to 2 units of energy produced
- Saving energy may reduce pollution. Energy production and use account to large proportion of air pollution and more than 83 percent of greenhouse gas emissions
- It is a duty to conserve today for tomorrow's use. An old Indian saying indicates "The earth, water and the air are not a gift to us from our parents but a loan from our children". (Source: Integrated Energy Policy Report2006, Planning Commission, GoI)

Power Scenario of Assam

Electricity consumption per capita in Assam is one of the lowest in the country. Assam accounted for only a small fraction i.e. 0.16 per cent of the total generation of electricity in the country during 2000-2001. On the contrary, consumption of power in the state has been increasing in the recent years. The average per capita consumption of electricity in the state was 120 Kwh in 2000-2001 and 140 Kwh in 2001-2002. (Source: ASEB)

Table 1. Sale of Electricity by Type of Consumers in Assam (In MKWP)

Type of consumption	1999-2000	2000-2001	2001-2002
Domestic	516.59	540.80	569.31
Commercial	150.63	155.84	164.06
Industrial (Total)	263.11	306.73	375.86
Low& medium voltage	18.75	23.14	24.36
High voltage	244.36	283.59	351.50
Public lighting	4.45	4.39	4.63
General purposes	22.95	26.89	28.32
Irrigation	10.34	9.01	9.49
Public water works	26.86	27.98	29.46
Tea garden	267.90	279.94	294.71
Bulk supply in the state	236.86	251.29	207.14
Total unit sold to ultimate consumers	1499.7	1602.87	1682.98

Source: ASEB

Assam has about 87% of the State's population living in rural areas. Out of a total number of more than

26000 villages in the State, 70% have been electrified. A large number of households in the State do not have electricity and use kerosene for lighting. Even for those areas, which are electrified, there is a tremendous shortage of power supply. Thus it is not uncommon for these areas to have 10 – 15 hours of blackouts and brownouts every day. As per 2001 census 87.09% of the total population of Assam live in 26,247 villages. As on March 31, 2006, 21,586 villages have been electrified through conventional grid by Assam State Electricity Board (ASEB). Thus the percentage of total villages electrified so far is about 82%. However, only 16.54% of the total households in these electrified villages have electricity connection. Thus while 83.46% of households in the already electrified 21,586 villages is still deprived of electricity, 4661 villages are still to see the light of electricity. (Source: ASEB)

The Study

Communication plays a central role in shaping people's understanding of the natural world and the role of humans therein. Such understandings, in turn, influence the way they act and their support for, or opposition to, specific policies. The media is a central arena for amplifying energy conservation issues and can influence the course of policy and the common masses.

The study is to explore the role of media in energy conservation especially in Guwahati city. Energy is more than just a commodity. It's a privilege. Most of the people don't realize that majority of the energy they use comes from non-renewable sources which consistently pollute air and water; in doing so they pollute themselves. With that being said, there are ways in which they can contribute personally to energy conservation and a more eco-friendly society. Some of the most convenient ways to conserve energy include: turning off lights when not in use, replacing traditional light bulbs with fluorescent ones, turning off power supply/unplugging electronics not being used, and regularly replacing home air conditioning filters etc. Energy conservation is not a one person job. However, just one person doing their part has potential to influence big change. Every person of the society has a duty to do their parts: as individuals and as a community to influence local and government change thus offering great hope for a healthier future.

Objectives of the Study

1. To comprehend the types of stakeholders should be involved in the communication process.
2. To analyze and the desired change in behavior.
3. To identify the constraints in communication with the citizen
4. To study which media of communication would be most effective for energy conservation
5. How will the communication process be monitored and evaluated?

Methodology

The present study was conducted by using mixed approach, combining quantitative information with the qualitative research methodologies. Structured interviews were conducted with the randomly selected household in

15 wards under the Guwahati Municipal Corporation area. Listing and review of existing IEC material were done in terms of media and messages used distribution/delivery, responsibilities and modalities of preparing the material etc. The field survey was conducted in September-October 2010.

Description of the Study Area

Guwahati is the largest city in the North-Eastern Region which is among the first 100 fastest growing city of the world and 5th fastest growing among Indian cities. Guwahati is recognized to be the most critical city in the Northeast India. The city has a well-developed connectivity with the rest of the country and acts as the gateway to the entire North Eastern India. Hence, the development of the city is not only critical to the state of Assam but also to the entire Northeast. It is the largest commercial, industrial and educational center of the N-E region. Given the criticality of the city to the entire region, it is quite evident that population of the city would continue to grow rapidly in the future. The total population covered under the Guwahati Metropolitan Area as per 2001 census is 8,90,773.

Limitations

Like many other research works and techniques, this study also have got some inherent limitations although not affecting much to the final output to any significant level.

Some of the limitations are:-

- Media role in communicating for energy conservation being a vast area of study, within a shorter time all issues related to this are not possible to investigate, however maximum care has been taken to cover most of the important issues.
- The survey restricted among the household consumers and vehicle users; not the industrial sectors, builders and other sectors.

Selection of Respondents and Sample Covered

(i) Selection of government officials: The concerned official from the headquarter of Assam State Electricity Board (ASEB) and Assam State Designated Agency (asda) and Assam Energy Development Agency have been selected for studying their communication initiatives in energy conservation.

(ii) Energy users/consumers: The structured questionnaire was administered amongst 125 respondents. The survey covered 80 males and 45 females in 15 wards of Guwahati Municipal Corporation areas. Majority of the respondents belonged to the literate category, except in case which are belongs to slam areas of the city. The respondents include homemakers, government servants, businessman, labors and drivers of public vehicles. More than 50 per cent of the respondents from all wards fall into income category of above Rs. 25,000 per month. 70% respondents have possesses vehicle in their family.

Findings of the Study

- Respondents' knowledge about energy conservation is not perfect.
- Respondents in the study areas are aware about the monetary losses due to their careless uses of electricity or LPG. However they are not informed about other relevant issues like pollution or other information that most of the fuels of the country are imported. They are also less interested about the issues like climate change or harmful effect of their household appliances at Ozone layer etc.
- More than 80% of the respondents from all the study areas have mentioned about the enhanced expenditure for installation of CFL bulb.
- Most of the household head informed that he is aware about the issue, however the same are not practices by their family members at their home though he discusses on the issue with the family members.
- The drivers who are also respondents of the survey mentioned that though they are aware about the fuel losses but never calculated that how much it looses in a month or in a year. They are never approached by anybody about the precaution of burning fuels at traffic signals or at the bus stand.
- The respondents are also blame governmental agencies for not following the energy conservation norms and office employees for careless uses of lights, fans, ACs and governmental vehicles.
- The official of ASEB has mentioned that the private company offices in the city are careless about the conservation of electricity as their bills are being paid by the corporate head office out side the state.
- The hotel owners who are also selected as respondent mentioned that consciousness is important among the general people as everything can't be controlled by enacting laws. They mentioned that most of the customers keep on the switches lights, fans, ACs etc. when that are not in use.
- The respondents (35%) mentioned about the high cost of the equipments uses in production of energy from renewable sources and poor after sales services for maintenances
- The majority of the respondents (60%) express their willingness to know more about the technology being utilized in production of energy from the renewable energy sources.
- On government initiatives, majority of the respondents mentioned that government action didn't touches the common masses; their activities restricted in organizing seminars at star hotels, competition in the aristocrat schools, clubs etc. Most of the literatures are in English, which are also information giving rather then persuasive.
- Respondents also stress upon the involvements of Non Governmental Organisations and renowned persons who can endorse messages to attract the common masses.

Media habits

- In most of the study areas relatives and friends are the major sources about energy conservation
- Majority of the respondents can't recall any advertisement or any notice which is appeared in any print or electronic media. Instead they prefer to know more on the subject from the media. They accused print and electronic media for ignoring the very sensitive issues though they pumped some other issues which are not relevant to them.
- As regard source preference for obtaining on energy conservation the largest portions of the respondents mentioned about TV and community meeting. Few respondents also preferred hand bill/pamphlets/ booklets. Help lines were also mentioned some of the respondents.
- Some of the respondents (20%) mentioned about the Electricity meter reader, who may be trained to impart tips and techniques on electricity saving methods to the customer at their home.
- In the study areas, majority of the respondents listen to radio programme for less than one hour a day.
- The survey reveals that most of the respondents agreed to participate in the energy conservation campaign.

Discussion

The process of social change starts with a stimulus which may from outside or from the within of a particular society. Media can generate that initiative on the energy conservation issue in the society informing shortage of electricity, finite sources of petroleum product, environmental pollution due to burning of fossil fuel etc. However it is extremely important that before launching any media activity the target audience have to be studied thoroughly.

Using mass media can be counterproductive if the channels used are not audience-appropriate, or if the message being delivered is too emotional, fear arousing, or controversial. Undesirable side effects usually can be avoided through proper formative research, knowledge of the audience, experience in linking media channels to audiences, and message testing. The finding of the survey reveals different choices of media. The study shows that better results or outcomes could be achieved with a combination of participatory media along with the other electronic and print media. After interacting with the respondents it is presumed that following media will be more effective for awareness campaign for energy conservation.

Poster: Posters can be designed to be both eye-catching and convey information. It is a visual which has to catch the attention of the audience and pass on to them a simple message at a glance. This medium may be useful to remind the tips and techniques of energy conservation.

Flash card: A flashcard is a set of cards bearing information, as words or numbers, on either or both sides, used in classroom drills or in private study. One writes a question on a card and an answer overleaf. Flashcards can bear vocabulary, historical dates, formulas or any subject matter that can be learned via a question and answer format. Each card is ‘flashed’ before the audience accompanied by the verbal commentary. The electricity meter reader can use this medium to covey a message of electricity conservation.

Bulletin board: A bulletin board can be utilized for display of news sheets, announcements, booklets, bulletins, circular letters, newspaper cutting etc. The board may be hanged at city bus stoppages, bus terminal, railway station, airport, shopping mall etc.

Exhibition: This medium is very useful to demonstration of various equipment of production of energy from the renewable energy sources. By seeing people may attract to use the equipment new machines.

Hoarding: Hoarding is another good medium to catch public attention. The medium is useful for any product or service at the introductory stage or repeating something for permanent behaviour change. Hoarding normally placed at busy areas where ‘opportunity to see’ is more.

Street play: Street play is one of the effective medium to highlight on any current issues like shortage of electricity, finite sources of fuel, rising demand of energy etc.

Folk songs and folk dances: There is really no such genre as folk dancing. Rather, there is a large body of unrelated non-classical dance forms. The only thing common among these dance forms is they are rural origins. This is a good medium for the people of slam areas of the city.

Meeting: Meeting is one of the important tools of communication. Meeting may be organized in every wards of the city. The citizen gets opportunity to ask questions during the interaction period with the resources persons.

Radio: Among the electronic media FM Radio is the popular medium in Guwahati city. The medium may be used to provide tips of energy saving in a regular interval.

Television: Television is also one of the popular medium in the surveyed villages. However the villagers watch TV mostly on entertainment purposes rather then as a medium of education or information. The medium have high potentials in creating awareness on energy conservation.

Newspaper: Newspaper is also a powerful medium creating awareness for energy conservation through the information providers or the extension workers. The vernacular newspapers are more useful in this regard.

Conclusion

With this limited investigation, it may conclude that media can be catalyst promotion of energy conservation and creation an energy conservation habits among the common masses. However it is important that media should carry the need based information applicable to the consumers' day-to-day life. It is also important that the message should be designed as per the receivers' education and fit with their local culture. Media is a good tool for this distribution and sharing of knowledge of tips and techniques for energy conservation which stimulate for growth and development of the energy sectors of the state/country. Media may empowers people to take rational and informed decisions through appropriate knowledge; inculcates necessary skills and optimism; facilitates, stimulates pertinent action through changed mindsets, modified behaviour and reinforces the same.

The government agencies should design and deliver participatory public communication campaign approach which should raise awareness and ease communication barriers among the agencies, institutions, governments departments, NGO/CBOs involved in public awareness campaigns capacity-building efforts in the state.

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171. A Comparative Study on the Frame of the Science News about Novel Swine-Origin Influenza A(H1N1)–Focused on Chosun Ilbo and The Kyunghyang Shinmun

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Abstract. This study analyzes news reports from Chosun Ilbo and The Kyunghyang about novel swine-origin influenza A(H1N1) focusing on framing. This study is designed with content analysis as the study method. One of the predominant results of this study was that Chosun Ilbo used more expert news sources than The Kyunghyang, and reported more exact science news because of that. Chosun Ilbo and The Kyunghyang also differed in main formal news frames and content news frames according to timeing.

Keywords: Content analysis, News frame, News source, Novel swine-origin influenza A(H1N1)

Introduction

As new kinds of epidemics have appeared since the late 1990s, people have increased concerns about their health. In a situation where the public can get information about a kind of epidemic from newspaper's science news, the study of science reports has become more and more important.

This study analyzes Chosun Ilbo's news and The Kyunghyang's news about novel swine-origin influenza A(H1N1) from April 27, 2009 to December 11, 2009.

This study focuses on the difference between sources for Chosun Ilbo and The Kyunghyang, and the difference of frames between Chosun Ilbo and The Kyunghyang.

Theoretical background

News source of science news

Because of the precise nature of science news, journalists covering science stories have to rely on scientists as news sources. Therefore, the selection of scientific experts in science reporting is important.

In a case study of reporting of the marijuana controversy, In Shepherd (1981) found that the media quoted as experts not primarily the most relevant and experienced researchers, but rather health administrators and highly prominent scientists, regardless of their specific field of expertise. From the perspective of journalists, it is not research productivity but other qualities that define a good public expert. Practitioners as well as senior scientists with overview knowledge and general experience may be better suited than the actual researchers in the subject matter to relate research to decision problems, to integrate different knowledge sources, and to provide contextualised expertise. Rothman (1990) has analysed possible biases in the selection of experts from a scientific community. He concludes from several case studies of expert controversies that journalists' selection of experts is biased: experts representing minority positions are usually overrepresented in the coverage. Kepplinger et at. (1991) argue that media tend to select expert sources that support their editorial policies. Goodell (1977) concludes that the media focus on relatively few 'visible scientists' and select scientific sources 'not for discoveries, for popularising, or for leading the scientific community, but for activities in the tumultuous world of politics and controversy'(Peters, 2008).

Frame theory

The frame of the press reconstructs the social reality of issues (Gamson & Modigliani, 1989). According to Gitlin (1980), reconstruction of the social reality of the frame is a pattern of continuous reinterpretation going through perceptions of reality, interpretation, selection, emphasis, and exclusion. Entman (1993) also pointed out reconstructive aspects by emphasizing the selectivity and salience of the frame. Iyengar and Simon (1993) said that in addition to studies of frame in psychological and social academia, many researchers tend to focus on research such as the story-line, symbolism and stereotypes which media appeared on media. Framing-events and issues affect how the news audience understands these events systematically (Price, Tewksbury & Powers, 1995; Price, Tewksbury & Powers, 1996).

Media frames can be summarized as 'the core ideas that audiences are aware of the aspects and consist of to interpret and evaluate in the direction of the aspects presenting by screening which issues, presenting specific aspects of the issue repeatedly, and strengthening' (Yang, M. S., 2001).

Subject and method of the study

Subject of the study

The source of science articles is based on the concept of the accuracy of scientific articles (Choi, Y. H., 1990). As we analyze scientific reporting, the frame is a useful theoretical background (Kweon, S. H., 2006). To compare sources and the frame of the new flu-related science news in Chosun Ilbo and The Kyunghyang Sinmun, research questions were set as follows:

[Research Questions 1] What differences are there between the sources of Chosun Ilbo and the sources of The Kyunghyang Shinmun on the new flu-related science news?

[Research Questions 2] What differences by stage are there between the frame of Chosun Ilbo and the frame of The Kyunghyang Shinmun on the new flu-related science news?

3.2 Method of the study

In this research, the unit of analysis was the text of a news article about the new flu. 684 news articles were analyzed from April 27, 2009 to December 11, 2009. Among them, the number of Chosun Ilbo's news articles was 386 and the number of The Kyunghyang's news articles was 298.

Referring to WHO epidemic alarm stage and Korean new flu epidemic crisis levels, articles were separated by three major stages (<Table 1>) and analyzed.

Analysis categories have news sources and frames. In news sources, subcategories have the kind of news source and the count of new sources. In frames, Iyengar (1991) divided frames by episodic and thematic frames. Subcategories have formal news frames, new flu generation causes frames, economic results frames, public agenda- centered frames, and disaster recognition frames.

This study used quantitative content analysis.

Frame analysis can be divided into the deductive approach method and the inductive approach method (Semetko & Valkenburg, 2000). In this research, using the deductive method, news frames were analyzed.

Table 1. Date and the Count by the Stage

Stages	Date	The Count of Chosun articles	The Count of Kyunghyang articles	Total
The first stage	2009.4.27 ~ 7.20	110	109	219
The middle stage	2009.7.21 ~ 11.2	213	127	340
The intensive stage	2009.11.3 ~ 12.10	61	60	121

Results of the Study

Sources of the new flu news

The analysis result of news sources of the new flu news are shown in <Table 2>. Chosun Ilbo used more Korean University news sources than The Kyunghyang, and The Kyunghyang used more anonymous and others, foreign media, and foreign government • administrative organizations news sources than Chosun Ilbo. Thus, Chosun Ilbo used fewer anonymous news sources and more Korean University news sources than The Kyunghyang. Therefore Chosun Ilbo used more expert news sources than The Kyunghyang.

Table 2. News source analysis results (plural check)

News sources / News Media	Chosun	Kyunghyang	News sources / News Media	Chosun	Kyunghyang
The Korean government Administrative Organizations	289 (40.4%)	212 (35.9%)	Foreign Companies	8 (1.1%)	4 (0.7%)
Korea Universities	72 (10.1%)	23 (3.9%)	Foreign Research institutions	2 (0.3%)	0 (0%)
Domestic Companies	32 (4.5%)	19 (3.2%)	Foreign public	1 (0.1%)	0 (0%)
Domestic Research institutions	3 (0.4%)	2 (0.3%)	Foreign Researches Councils societies	0 (0%)	2 (0.3%)
Domestic public	7 (0.8%)	0 (0%)	Foreign Others	10 (1.4%)	1 (0.2%)
Domestic Researches Councils societies	6 (0.7%)	6 (1%)	International Organizations	35 (4.9%)	33 (5.6%)
Domestic Others	49 (6.9%)	27 (4.6%)	Domestic media	1 (0.1%)	1 (0.2%)
The foreign government Administrative Organizations	51 (7.1%)	66 (11.2%)	Foreign media	58 (8.1%)	75 (12.7%)
Foreign Universities	2 (0.3%)	1 (0.2%)	Anonymous and Others	89 (12.4%)	118 (20%)
Total	715 (100%)	590 (100%)	Total	715 (100%)	590 (100%)

Frames of the new flu news

Formal news frames: The analysis result of formal news frames are shown in <Table 3, 4>. Formal news frames had many episodic frames (48%). Both newspapers have many episodic frames, and The Kyunghyang has more thematic frames (43.6%) and episodic frames (51%) than Chosun Ilbo. In the first stage and the middle state, episodic frames were 50.7% and 50.9% respectively, and their percentages were high. In the intensive stage, the percentage of thematic frames (38%) was higher. Chosun Ilbo had more episodic frames than The Kyunghyang and The Kyunghyang had more thematic frames than Chosun Ilbo in the first stage. The Kyunghyang had more thematic frames and episodic frames than Chosun Ilbo in the middle stage and the intensive stage.

Content news frames: The analysis results of content news frames are shown in <Table 5>. Content news frames were public agenda-centered frames (77.9%), disaster recognition frames (68.1%), new flu generation causes frames (19.7%) and economic results frames (10.5%) in descending order. Chosun Ilbo had more all content news frames than The Kyunghyang. Content news frames had many public agenda-centered frames in all stages, had many economic results frames (11%) in the first stage and had many new flu generation causes frames (22.1%), public agenda-centered frames (85%), and disaster recognition frames (71.8%) in the middle stage.

Table 3. Formal news frames analysis results by the stage

		Stages		
		The first stage	The middle stage	The intensive stage
Formal news frames	Thematic Frames	85 (38.8%)	109 (32.1%)	46 (38%)
	Episodic frames	111 (50.7%)	173 (50.9%)	43 (35.5%)
	Nothing	23 (10.3%)	58 (17%)	32 (26.5%)
Total		219 (100%)	340 (100%)	121 (100%)

Table 4. Formal news frames analysis results by the stage and news media

		Stages					
		The first stage		The middle stage		The intensive stage	
		News media		News media		News media	
		Chosun	Kyunghyang	Chosun	Kyunghyang	Chosun	Kyunghyang
Formal news frames	Thematic Frames	38 (34.5%)	47 (43.1%)	56 (26.3%)	53 (41.7%)	17 (27.9%)	29 (48.3%)
	Episodic frames	57 (51.8%)	54 (49.5%)	102 (47.9%)	71 (55.9%)	16 (26.2%)	27 (45%)
	Nothing	15 (13.6%)	8 (7.3%)	55 (25.8%)	3 (2.4%)	28 (45.9%)	4 (6.7%)
Total		110 (100%)	109 (100%)	213 (100%)	127 (100%)	61 (100%)	60 (100%)

Table 5. Content news frames analysis results by the stage (plural check)

Content news frames	New flu generation causes frames Economic results

frames

S
t
a
g
e
s

The first stage
The middle stage
The intensive stage

41
75
19

(18.7%)
(22.1%)
(15.7%)

24
37
11

(11%)
(10.9%)
(9.1%)

Public agenda- Centered frames 153 289
89

(69.9%) (85%)
(73.6%)

Disaster recognition frames 138 244
81

(63%) (71.8%)
(66.9%)

366

Conclusions and Implications of the Study

Conclusions

This research focused on exploring whether there are differences in sources and frames of science news through content analysis of Korean newspapers. As a result of statistical analyses, Chosun Ilbo used more expert news sources than The Kyunghyang and reported more exact science news due to more expert news sources. Formal news frames had many episodic frames. Both newspapers had many episodic frames, and The Kyunghyang had more thematic frames and episodic frames than Chosun Ilbo. In the first stage and the middle state, the percentage of episodic frames was high. In the intensive stage, the percentage of thematic frames was higher. In the first stage, Chosun Ilbo had more episodic frames than The Kyunghyang and The Kyunghyang had more thematic frames than Chosun Ilbo. In the middle stage and the intensive stage, The Kyunghyang had more thematic and episodic frames than Chosun Ilbo. Content news frames were public agenda-centered frames, disaster recognition frames, new flu generation causes frames, and economic results frames, in descending order. Chosun Ilbo had more all content news frames than The Kyunghyang. Content news frames had many public agenda-centered frames in all stages, many economic results frames in the first stage, and many new flu generation causes frames, public agenda-centered frames and disaster recognition frames in the middle stage.

Korean newspapers should use professional scientists as more sources and decrease anonymous sources in order to cover more accurate science news.

Chosun Ilbo and The Kyunghyang changed in main formal news frames and content news frames according to the time period. Korean newspapers saw the same themes as a different frame according to the time period.

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172. Understanding the Roles of Value Predispositions, Mass Media, and Cognitive Processing in Public Attitudes toward Nanotechnology

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Abstract. This study examines how value predispositions, communication variables, and perceptions of risks and benefits are associated with public support for federal funding of nanotechnology. Our findings show that highly religious individuals were less supportive of funding of nanotech than the less religious individuals, whereas individuals who held a high deference for scientific authority were more supportive of funding of the emerging technology than those low in deference. Mass media use and elaborative processing of scientific news were positively associated with public support for funding, whereas factual scientific knowledge had no significant association with policy choices. We conclude with policy implications that will be useful for policymakers and science communication practitioners.

Keywords: Mass media; Elaborative processing; Interpersonal discussion; Risk; Nanotechnology

Introduction

Nanotechnology is projected by the federal government to be the defining technology of the twenty-first century, with the potential to drive our next industrial revolution (National Science and Technology Council 2000). According to the 2006 State of the Union Speech by President George W. Bush, nanotech is among the emerging technologies for which funding will be doubled over the next ten years in the United States. With wide applications cutting across important sectors such as medicine and healthcare, environment, and national defense, nanotech promises to overcome many of the challenges that the world faces today (National Science and Technology Council 2000). In 2007 alone, \$147 billion worth of nanotech-enabled products were produced in the market and the annual global revenue of nanotech-based products is expected to reach \$3.1 trillion by 2015 (Lux Research 2008). Despite this, there are fears that the novel technology could lead to various health and environmental problems, and other negative social, moral, and ethical consequences (Bainbridge 2003; Sententia 2004; PCAST 2005).

Currently, the American public is unaware of the potential risks and benefits of this emerging technology (Scheufele and Lewenstein 2005). Public opinion about nanotech is likely to have a bearing on future funding-related policies (Roco and Bainbridge 2003). Although the U.S. is currently leading the "nano race" in terms of public and private funding (European Commission 2005), this technological supremacy may be threatened if public attitudes toward nanotech were to turn negative. For example, if funding and infrastructure support for nano-scientists in the U.S. were insufficient, they may choose to relocate their research base to other countries with more attractive funding opportunities. Ensuring constant funding initiatives for nanotech will enable the U.S. to remain competitive in the international arena and to sustain a positive climate for science and technology in the country. Since the public is primarily unfamiliar with nanotech at this early stage, examining the mechanism behind how public form attitude toward support for federal funding of nanotech is pertinent.

Thus far, there are two lines of assertions that explain how the public form attitudes toward nanotech. First, the "familiarity hypothesis" asserts that public support for nanotech will likely grow as awareness or knowledge of it expands. Using meta-analyses of public opinion studies of nanotech, Satterfield et al (2009) have demonstrated that familiarity with nanotech is correlated with positive attitudes toward it, in which members of the public who claim to know a lot about nanotech were substantially more likely to believe its benefits outweigh its risks. Conversely, the predisposition argument asserts that personal values and heuristics could play a bigger part in shaping public attitudes toward nanotech. For example, individuals who hold a pro-science and technology orientation are predisposed to seek out scientific information from the mass media, to discuss science with others, which in turn, produces positive attitudes toward nanotech (Vandermoere et al. 2009).

Since these arguments are far from conclusive, this study aims to use a holistic approach to examine how both cognitive and heuristic factors can potentially shape public level of support for federal funding of nanotech. Previous research have shown that public attitudes toward emerging technologies are associated with value predispositions such as religious beliefs and deference to scientific authority, and other heuristic cues such as risk and benefit perceptions (e.g., Ho et al. 2008; Nisbet et al. 2002; Priest 2001; Priest et al. 2003). Scholars have also shown that the public often rely on positive frames and/or information in the media to form favorable attitudes toward nanotech (e.g., Brossard et al. 2009; Lee et al. 2005; Scheufele and Lewenstein 2005).

In addition, individuals' use of cognitive processing strategies to reflect upon and absorb the scientific information that they gathered from the mass media can also be associated with their acceptance of the new technology. Scientific knowledge has been demonstrated to have a small association with public acceptance of emerging technologies (e.g., Miller et al. 1997; Miller and Kimmel 2001). We will therefore examine how these factors are associated with public support for funding of nanotech in this study.

Value predispositions

Religious guidance is a likely heuristic cue in which the public will depend on to form judgments about nanotechnology. Recent research has shown that religious guidance is one of the major factors associated with public resistance to emerging science and technologies (Brossard et al. 2009; Gaskell et al. 2005; Ho et al. 2008; Nisbet 2005). This is hardly surprising given the historical intransigence and normative inconsistencies between religion and science (Brooke 1998; Miller et al. 1997). One explanation for this tension has to do with the perception that science tampers with nature or is akin to playing God, putting it at odds with religious beliefs (Sjoberg 2004; Sjoberg and Winroth 1986).

Nanotech is not spared from the potential friction between religion and science. The U.S. Food and Drug Administration officially defined nanotech as part of the Nano-Bio-Info-Cogno (NBIC) technologies that highlight the unity of nature at the nanoscale, and the intelligible processes of evolution that have constructed life and intelligence, from the nanoscale, without divine intervention (Bainbridge 2003; Sententia 2004). Bainbridge (2003) argued that this all-inclusive approach to nanotech may go against people's religious beliefs and reduce their support for the emerging technology.

Brossard et al. (2009) found a negative relationship between the strength of religious beliefs and support for funding of nanotech among the U.S. public. They concluded that people use religiosity as an attitudinal filter when it comes to forming opinions about the new technology. Religious people may lump nanotech, biotech, and stem cell research together and perceive them as means to enhance human qualities. In short, some people may believe that researchers are "playing God" when they create materials that do not occur in nature, especially where nanotech and biotech intertwine. Based on these considerations, we therefore hypothesize that religious beliefs will be negatively associated with public support for federal funding of nanotech (Hypothesis 1).

Deference to scientific authority is another value predisposition that can be associated with attitudes toward science and technology (Brossard and Nisbet 2007; Ho et al. 2008). Deference to scientific authority is defined as "a long-term socialized trait that guides citizens' responses to a range of technical controversies" (Brossard and Nisbet 2007, p. 10). Studies have demonstrated that the more individuals defer to scientific authority, the more likely they were to hold positive views on controversial scientific issues (e.g., Brossard and Nisbet 2007; Ho et al. 2008). The American educational system has instilled a strong sense of respect for scientists and scientific institutions among the citizens, and this has fostered a culture of deference to scientific authority in the U.S. These have been reflected in education that involved teaching people to view scientific research as solitary activities that are kept away from external social and political pressures (Bimber and Guston 1995), and to perceive science as a pure and unbiased pursuit that increases our knowledge about the world (Irwin 2001). Hence, we posit that deference for scientific authority will be positively associated with public support for federal funding of nanotech (Hypothesis 2).

Mass media

The mass media is the main source of information about science and technology for majority of the public (Pew Internet and American Life Project 2006), and media coverage have been shown to play an important role in shaping public attitude toward science and technology (Ho et al. 2007, 2008; Nisbet et al. 2003; Nisbet and Lewenstein 2002). In a content analysis of the New York Times from 2000 to 2003, Gaskell et al. (2004) found an overwhelming coverage of benefits than risks for nanotech, and concluded that "media coverage is more slanted towards a supportive culture of science and technology in the U.S." (p. 496)

Likewise, by examining nanotech coverage in major U.S. and non-U.S. newspapers published from 1988 through 2004, Stephens (2005) found that the proportion of articles in which benefits outweighing risks (versus risks outweighing benefits) is three to one. Friedman and Egolf (2005) shown that even when health and environmental risks were covered in the U.S. newspapers, most of the articles published were balanced and described risks with both positive and negative information. The researchers concluded that news coverage in the U.S. would positively influence public opinion about nanotech (see also, Scheufele and Lewenstein 2005).

Besides this, some scholars have argued that the tone of media coverage of nanotech can serve as a simple decision rule in influencing the risks and benefits considerations among the public (Nisbet and Scheufele 2007; Scheufele and Lewenstein 2005). This is manifested in the form of media frames in which audiences use these heuristic cues as shortcuts for processing new information in a short time (Scheufele 1999). Studies have shown that framing of nanotech has an effect on how audience perceived risks and benefits of the technology (e.g., Cacciatore, Scheufele and Corley, 2009; Cobb 2005; Schutz and Wiedemann 2008).

In essence, the mass media has a dual function. On one hand, the media are information providers that offer a source of informal learning about emerging science for most Americans. On the other hand, media frames such as the positive tone of coverage about nanotech offer audience the heuristic cues to make quick decisions about the technology (Scheufele and Lewenstein 2005). Given the overall positive content and valence of the news media on nanotech over the past few years, we postulate that mass media use will be positively associated with public support for federal funding of nanotech (Hypothesis 3).

Elaborative processing and interpersonal discussion

Going beyond mass media use, individuals' cognitive processing in the form of reflective integration (i.e., news elaboration and interpersonal discussion about scientific issues) can be associated with public attitude towards nanotech. Cognitive information-processing strategies are defined (Kosicki and McLeod 1990) as "tactics that individuals use to try to cope with the amount and kind of mass media information that they encounter in their everyday lives" (p. 73). Most people are cognitive misers who tend to engage in reflective integration to sift out media messages that are useful to them. Specifically, reflective integration consist of thinking about a specific issue covered in the mass media (i.e., news elaboration) and talking about it with others by connecting it with preexisting knowledge (i.e., interpersonal discussion) (Eveland 2001, 2002; Eveland and Thomson 2006).

Elaboration is a behavioral style that people use to associate new ideas and information with what is already known, look for similarities with past experiences, and find ways to apply the information (Eveland 2002). Any new information incorporated into a pre-existing knowledge structure through the process of news elaboration will promote a deeper understanding of the scientific world. Likewise, interpersonal discussion (Kosicki and McLeod 1990; Scheufele 2001, 2002) involves talking to other people about mass-mediated issues, discussing the pros and cons, and weighing alternatives to reach a conclusion. Discussions with family, friends, neighbors, and co-workers are likely to reinforce mass media effects (Johnson 1993). Since the media has on the most part portrayed nanotech and science in general favorably, interpersonal discussion about science and nanotech should reinforce this perspective.

Reflective integration can promote a deeper understanding of the scientific world and provide a stronger cognitive base and sophisticated knowledge structure for opinion formation about scientific issues than simple factual, textbook-style scientific knowledge. By sophisticated knowledge, we are referring to the ability of individuals to associate, integrate, and relate various news issues or topics, which will also include the knowledge of how concepts within a specific domain are interrelated. We therefore hypothesize that elaborative processing will be positively associated with public support for federal funding of nanotech (Hypothesis 4) and that science discussion will be positively associated with public support for funding (Hypothesis 5).

Factual scientific knowledge

Scientists and policymakers have assumed that greater scientific literacy enables individuals to sort through the misinformation and extraordinary claims that emerge during scientific disagreements (Bodmer 1985). Scholars also assume that highly knowledgeable public would be more supportive of scientific research (Miller 1998, 2004). Scientific knowledge has been shown to have direct positive relation with public perceptions of scientific issues

(Brossard et al. 2005; Nisbet et al. 2002; Sturgis et al. 2005), and to have contingent associations with public attitudes toward science and technology (e.g., Brossard et al. 2009; Ho et al. 2008; Sturgis and Allum 2004). However, some studies have shown that factual scientific knowledge had little or no relationships with public acceptance of new technologies (e.g., Allum et al. 2005; Priest 2001).We therefore pose the following research question: How will scientific knowledge be associated with public support for federal funding of nanotech? (Research Question 1)

Trust in scientists

Trust refers to citizens' willingness to rely on the endorsements of experts, such as scientists and regulators, as well as institutions such as the federal government, to manage risks associated with emerging technologies (Earle and Cvetkovich 1995; Giddens 1991; Luhmann 1979; Sztompka 1999). Giddens (1991) pointed out that trust in a variety of abstract systems is a necessary part of everyday life, and the characteristics of abstract systems imply constant interaction with "absent others" – people we have never met but whose actions directly affect our lives. Irwin and Wynne (1996) demonstrated that people were much more concerned with whom to trust than with the scientific aspects of an issue itself. Trust is a state-like disposition which acts as an uncertainty reduction mechanism, driving down citizens' concerns over the unforeseen risks and costs of emerging science and technologies (Freudenburg 1992,
1993; Slovic 1999), thereby enabling citizens to form judgments about emerging technology without understanding the risks involved.

Numerous studies found trust in relevant actors to be positively associated with support for emerging science such as biotech (Brossard and Nisbet 2007; Brossard and Shanahan 2003; Priest 2001; Priest et al. 2003; Sinclair and Irani 2005), gene technology (Siegrist 2000), stem cell research (Ho et al. 2008), and nanotech (Ho et al. forthcoming; Lee et al. 2005). Trust as a tool in decision-making is efficient when individuals have limited knowledge and personal experience, and when they have little chance to anticipate the future consequences of a particular technology (Olofsson et al. 2006). This is highly applicable to the emerging nanotech field with which most people are unfamiliar with. Therefore, it is likely that trust in scientists will be positively associated with public support for funding of nanotech (Hypothesis 6).

Perceptions of risks and benefits

Public perceptions of risks and benefits can be related to their decision-making about funding for nanotech. Coming from the psychometric approach, Slovic (1987) defines risk perceptions as "the judgments people make when they are asked to characterize and evaluate hazardous activities and technologies" (p. 280). Research have shown that the public tend to perceive hazards as risky if they are not within their control (Starr 1969), seem "dreadful" and "novel" (Fischhoff et al. 1978), and interfere with nature (Sjoberg 2002). The more individuals perceive a hazard or a technology as risky, the less likely they are to accept it.

Numerous studies have found that perceived risks and benefits are associated with levels of acceptance of technology (Frewer et al. 1998; Siegrist 2000; Siegrist et al. 2000; Sjoberg 2002, 2004). For example, Siegrist (2000) demonstrated that while perceived benefits was positively associated with acceptance of gene technology, perceived risks was negatively associated with support for the technology. Sjoberg (2004) opined that outright rejection of an emerging technology is often a function of perceived high risks in the technology per se. Given the fact that the "real" risks are not apparent for nanotech at the current stage of its development, and media coverage of this emerging technology is overwhelmingly positive, simply examining risks perception without consideration for the perceived benefits of the technology would preclude us from gaining a full understanding of public opinion. Hence, it is worthwhile to examine the relationship between perceptions of risks and benefits and public support for funding of nanotech. We hypothesize the following: Perceived risks will be negatively associated with public support for federal funding of nanotech (Hypothesis 7) and perceived benefits will be positively associated with public support for federal funding of nanotech (Hypothesis 8).

Methods

Our data came from a nationally representative random-digit-dial telephone survey of U.S. adult respondents aged 18 years and over (N = 1,015). The University of XXX Survey Center conducted the fieldwork between May and July 2007 with an average length of 21.47 minutes per interview. The margin of error was approximately +/ 3%. A significant amount of time and effort were put into call-backs and refusal conversions to minimize systematic non- response. The overall response rate for this survey was 30.6% (based on AAPOR response rate formula 3).

Hierarchical OLS regression analysis was used to investigate the relationships between the independent variables and public support for funding of nanotech. The variables were entered into the regression model based on their assumed order: the control variables (i.e., age, gender, and SES) were entered in the first block, followed by value predispositions (i.e., religious beliefs and deference to scientific authority), mass media use, reflective integration (i.e., elaborative processing and science discussion), factual scientific knowledge, and finally, other perceptions (i.e., trust in scientists and risks and benefits perceptions of nanotech).

Results

Table 1 shows the hierarchical OLS regression analysis for support for federal funding of nanotech. The results show that all the control and independent variables were significantly correlated with public support for funding of nanotech at the zero-order level, indicating potential multivariate relationships between them.

The first block of final standardized beta coefficients indicates the role of the demographic variables. Age, gender, and SES were initially correlated with support for funding at the zero-order level, but the significant associations were fully explained away by the independent variables that were subsequently entered into the regression model. The demographic block accounted for 6.80% of the variance in the model.

Table 1. Hierarchical OLS Regression Analysis for Public Support for Federal Funding of Nanotechnology

Variables	Zero-Order Correlations	Final Standardized Beta
Block 1: Demographics		
Age	-.15***	-.05
Gender	-.10***	-.01
SES	.23***	.04
Incremental R2 (%)		6.80***
Block 2: Value Predispositions		
Religious beliefs	-.21***	-.09***
Deference to scientific authority	.29***	.12***
Incremental R2 (%)		9.30***
Block 3: Mass Media		
Mass media use	.33***	.07*
Incremental R2 (%)		5.70***
Block 4: Reflective Integration		
Elaborative processing	.31***	.06*
Science discussion	.28***	.05
Incremental R2 (%)		2.80***
Block 5: Knowledge		
Factual scientific knowledge	.22***	.00
Incremental R2 (%)		.00
Block 6: Other Perceptions		
Trust in scientists	.43***	.13***
Perceived risks	.06*	

-.10** Perceived

benefits .54***

.40*** Incremental R2 (%)

14.50*** Total R2 (%)

39.30***

*p<.05. **p<.01. ***p<.001.

When it comes to value predispositions, the negative final standardized beta coefficient shows that highly religious individuals were significantly less supportive of nanotech funding than the less religious individuals. Conversely, the positive beta coefficient indicates that individuals who had a high deference for scientific authority were significantly more supportive of funding of the emerging technology than those low in deference. Hence, both H1 and H2 were supported. The value predispositions block explained 9.30% of the variance in our model.

After controlling for the demographics and value predispositions, our results show that mass media use and elaborative processing were positively associated with public support for funding. However, interpersonal discussion of scientific issues had no significant association with the dependent variable. Therefore, H3 and H4 were supported, but not H5. The science media use and reflective integration blocks accounted for a combined 8.50% of the variance in public support for funding. With respect to RQ1, our results indicate that factual scientific knowledge had no significant association with policy choices.

Finally, the positive beta coefficients indicate that individuals who had a lot of trust in scientists were more supportive of nanotech funding than those who had a low trust in scientists. Perceptions of risks were negatively, while perceptions of benefits were positively associated with public support for funding of nanotech. This supported H6, H7, and H8. The final block accounted for 14.50% of the variance in our dependent variable. In total, the factors explained 39.30% of the variance in our model.

Discussion

This study examined the associations of value predispositions, mass media use, reflective integration, factual scientific knowledge, trust in scientists, and risks and benefits perception with public support for federal funding of nanotech. Overall, our findings provide support for the hypothesis that mass media use had a positive association with public support for federal funding of nanotech. Notably, the results support the hypothesis that elaborative processing was positively associated with public attitude towards nanotech. Heuristics in the form of value predispositions, trust, and risks and benefits perceptions were also shown to have bearings on public support for funding. Taken together, these findings underscore the important roles of cognitive and heuristic cues when it comes to understanding how the public form attitude towards emerging technologies. Using this holistic approach, the findings are useful for designing more effective science communication and public outreach efforts.

Consistent with results from previous studies (e.g., Brossard et al. 2009; Ho et al. 2008; Nisbet 2005), this study showed that religious belief was negatively related to public support for federal funding of the emerging technology. The normative contradictions between science and religion (Brooke 1998; Miller et al. 1997) may be an explanation for the relationships found between religious guidance and acceptance of nanotech. In addition, the fact that religious people may perceive nanotech, biotech, and stem cell research together as means to enhance human qualities, hence tampering with nature by playing God (Sjoberg 2004; Sjoberg and Winroth 1986) may plausibly explain the negative relationship.

On the other hand, individuals' deference for scientific authority and trust in scientists are two positive factors associated with public acceptance of nanotech, consistent with findings from previous research (Brossard and Nisbet 2007; Ho et al. 2008; Lee et al. 2005). Again, these findings are not surprising because, as tools in decision-making, deference for scientific authority and trust in scientists are efficient when knowledge and personal experience are limited, especially when it comes to nanotech. In addition, the independent effects of deference to scientific authority and trust in scientist on public attitudes toward nanotech suggest that researchers should adopt a fine-grained approach to examine these concepts separately in future studies as they are essentially different entities.

Next, this study shows that the public utilize positive frames derived from the mass media as heuristic cues to make decision about acceptance of the emerging technology, which is congruent to results of previous studies (Brossard and Nisbet 2007; Lee and Scheufele 2006; Lee et al. 2005; Scheufele and Lewenstein 2005) and consistent with framing effects of the media (Kahneman and Tversky 1979; Scheufele 1999). This could plausibly be explained by the fact that media outlets are the major gateway to nanotech for most Americans (Castellini et al. 2007) and that the tone of media coverage of nanotech has been overwhelmingly optimistic in the past few years (Bainbridge 2002; Gaskell et al. 2004).

Besides this, elaborative processing plays an important role in shaping public support for federal funding of the new technology. This could be explained by the fact that people who actively process and synthesize information from the mass media build a larger knowledge structure about science generally, and nanotech specifically, in their memory. This new scientific information could be easily accessed for people to formulate judgments about nanotech acceptance. Nanotech has been covered in overwhelmingly positive light in the mass media and it is therefore, not surprising that these positive information become part of the audience memory when audiences reflect and integrate the materials they attended to in the news.

Contrary to our expectation, scientific discussion was not found to be significantly associated with public support for federal funding of nanotech. Interpersonal discussion with others about scientific issues was initially correlated with support for funding at the zero-order level, but the relationship was explained away by other variables (e.g., perceived risks and benefits) that were subsequently entered into the regression model. Another plausible explanation may be that people may not be talking about nanotech per se in their discussions about scientific issues, and therefore the association with attitude towards the emerging technology is not strong.

Consistent with results of previous studies (e.g., Brossard et al 2009), individuals who perceived greater risks of nanotech were less supportive of nanotech funding, while those who perceived greater benefits were more supportive of funding for nanotech. This suggests that the public rely on risks and benefits perceptions as heuristic cues to form judgment about nanotech.

This study has important policy implications that will be useful for policymakers and science communication practitioners. Given that there are various groups that have different opinions about nanotech (such as the highly religious public), science communication practitioners should adopt the target segmentation strategy, in which communication messages are tailored to fit with publics from different social backgrounds for maximum effect. For example, to reach out to the religious public, scientific institutions should strengthen partnerships with religious institutions by arranging scientists to speak on topics related to nanotech and inviting religious leaders to address scientists on issues of concern.

At the same time, policymakers and the relevant scientific institutions should find ways to promote and instill trust in scientists and deference to scientific authority among the public (e.g., arranging eminent scientists to conduct seminars for high-school students) so as to counter the opposing force that religious guidance could potentially play in shaping opinion about nanotech. In addition, trust in nano-scientists both in academia and industry is crucial to sustain public support for nanotech. Therefore, government regulatory bodies should ensure that the necessary guidelines are in place (e.g., guidelines to manage toxicity related to nanotech and health standards for creating commercial products) so that public confidence and trust is maintained.

Given the findings that the mass media play a key role in shaping public perceptions of nanotech by providing heuristic cues and/or information, policymakers and scientists should learn to focus on framing their messages in ways that connect with diverse audience. For example, when scientists are speaking to a group of businessmen, they should emphasize the economic relevance of science by pointing out that expanded government funding would make the U.S. more economically competitive. It is important for public officials, scientists, and science communicators to pay attention to new developments in media coverage of nanotech to monitor public opinion movements, especially when the issue of nanotech enters into a different stage of the issue-attention cycle. The mass media could also be a point of intervention for public officials as they could provide accurate and up-to-date information about nanotech to the public so as to sustain positive public opinion. For example, public officials could use the mass media as an avenue, such as running campaigns and sponsoring science programs on PBS channels, to offer accurate and up-to-date information about nanotech to the public.

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173. Study about "Pseudo-science on Mass Media"

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Abstract. In China, after dissemination by mass media, some pseudo-scientific knowledge was popular in the name of traditional health care and specific features. However, these pseudo-science was doubted by the voices from new media, would soon be laid bare the true face. The strong contrast reflects some problems in science communication and mass media's development. Why pseudo-science can get big spread on mass media, this article tries to find out the reasons---the mass media's pursuit to commercial interests;the absence of "gatekeeper";the lack of effective communication between scientific research institutions, professional media and mass media.

After media system reformed in China, some of mass media regard ratings and circulation as the most important, and ignore the authenticity and objectivity in science communication. They prefer to report these things that can attract people's eye, even have not time and ability to verify if their coverage is pseudo-science. Scientific research institutions and professional media pay less attention to science communication,compared to research .The lack of effective communication between them and mass media,result scientific knowledge can not be transmitted to the public timely and accurately. Then,we have to receive pseudo-scientific knowledge on tv ,newspaper, magazine,etc.

Some people think that pseudo-science is just harmless fun. But some people deceive the public by fabricating and spreading false knowledge deliberately, to get money or other benefits. As the Chinese media has a strong authority and credibility the public is willing to believe the media reports. Once the pseudo-science was reported on mass media, it will have a bad effects on society.The spread of pseudo-science can damage mass media's credibility, expand the "knowledge gap" further,and is not conducive to improve chinese Scientific Literacy and Creativity.

Why pseudo-science was criticized by the whole society in a short time? The development of new media makes every person become a reporter and a gatekeeper. At the lack of communication with traditional media,scientists can use new media to communicate with the public directly, and eliminate the false and retain the true. However, each person can spread pseudo-science on new media.

How to reduce or eliminate the spread of pseudo-science on traditional media? Some successful practices abroad tell us, we should reform media system further, improve mass media's responsibility,for example, ratings should not be the only standard in television program.We should also improve the science communication capacity by urging scientific research institutions and professional media take part in science communication actively and enhance cooperation with mass media. To BBC, for example, the science documentary's script is often validated by the scientists or involved in writing in person, to ensure the authenticity and objectivity in science communication. The staff responsible for science communication in BBC, received high scientific training, some have gone beyond the identity of media workers.In essence, they have already become scientists with peculiar work way.

174. Emerging Trends of Media in Alteration of Mind Set for the Attitudinally Rational Society

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Abstract. Media plays pivotal role in alteration of mind set and thoughts. It also assists to reset the priority of decision to unveil the innovation and scientific rationalities for bringing the societal change. It is an axiomatic fact that knowledge is the vital factor of the human behavior, paves the path of development. Human being is blessed with the power of discrimination, which accrues the unique attributes and makes the people indifferent. Developing country like India facing the profound challenges to bring the rational changes in pre mind set of society. Science communication has the pace to bring the desirable change. Strong intervention of media offers the platform for politically aware, economically viable and ecologically balances society. Intelligently integrate our ideas and management strategies to develop strong media-led base paraphernalia to fulfill the societal needs is indispensable defy. Marshal Mac Luchan and Denial Lerner enumerated the mass media as an instrument of a social change. This paper will divulge the significance of emerging trends of media in alteration of mind set for the attitudinally rational society. Media as a medium of non-formal education assist the radical change of mindset and a strong belief in innovativeness and management-of-change concept.

175. Are New Media Used to Boost Social Appropriation in Latin American Countries?

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Abstract. In this paper we analyze the way in which governmental institutions in Latin American countries are implementing new media communication tools to engage the public on issues involving science and technology (S&T). Focusing on the four countries with the highest proportion of Internet users in Latin America (Brazil, Mexico, Argentina, Colombia) the paper analyzes the online communication by the representative governmental institutions in charge of S&T public policy. These institutions play a predominant role in establishing public policy in S&T and in supporting social appropriation of science. The exponential growth of Internet users in these developing countries makes the web 2.0[1] (web applications that facilitate interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web) an ideal platform not only to improve public understanding of science and diffuse every kind of science communication activities, but also to enable society to make use of scientific knowledge. Furthermore, it can serve as a mechanism for engaging citizens in setting the policy-making agenda and influencing the allocation of financial resources. The paper highlights the role of governments in challenging the still dominant assumption that science literacy is both the problem and the solution to the growing knowledge-based economy and consequently to development. Science and Technology governmental institutions need to execute all the available capabilities to inform, influence and persuade, utilizing innovative instruments to reach all of their different audiences (especially the ones under-target). Guided by a set of established criteria, the paper conducts a reviewing of the institutional web page of each major national S&T institution and the online communications efforts of the most relevant activities that have already been developed by that institution. The essay then offers a set of detailed recommendations for improved public appropriation of science through the development of communications strategies based in that leverage new media using.

1 Web 2.0 (coined by Tim O'Reilly) has been noted as the shift from a flat "web 1.0" world to a more dynamic and quick changing web

2.0 world. Some of the key shifts include: the rise of social networking, online blogging, video and audio, and user generated and edited content. People browsing the web now have thousands of new tools and web sites at their fingertips to interact with people and find the information they are looking for.

176. Coverage of Research News in Indian Newspapers

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Abstract. The present study has been undertaken with the objective of accessing the coverage of research news cum science communication in Indian print media. A content analysis of five English newspapers revealed that newspapers published research news items relating to medical sciences, physical sciences, social sciences, business & management & IT. Frequency of R.N. is negligible, 1.2 per day per newspaper. A strong positive relationship emerged between the newspapers' readership and frequency of research news appearance. Findings indicate that newspapers reported Indian R.N. in a big way followed by US and UK. Newspapers' own correspondents and news networks wrote maximum stories rather than news agencies. The news agencies reported R.N. from different countries without any preference for their native country. The study coined two hypotheses out of which one was rejected and alternative hypothesis was accepted. The study dwelt at length on various issues relating to R.N.

Keywords: Content analysis, Print media coverage, Research news

Introduction

Kerlinger (1986) defines scientific research as a systematic, controlled, empirical, and critical investigation of hypothetical propositions about the presumed relations among observed phenomenon. Research is the locomotive in which the development of society moves forward. It is the first pillar of scientific thinking. Creative ideas and innovations originate from research. 'Why' and 'how' are the most important words in research which demystify the secrets of a particular problem under study and leads to truth and knowledge.

Wimmer and Dominick (1994) mention four events or social forces which contributed to the growth of mass media research. First was world war 1 which prompted a need to further understand the propaganda. Second was the realization by the advertisers in 1950s and 1960s the research data were useful in devising ways to persuade potential customers to buy products and services. Third was the increasing interest of citizens in the effects of the media on public, especially on children. Fourth one was the increased competition among the media for advertising dollars.

A Registrar of Newspapers for India's 2006 report states that India has 62,483 registered newspapers having a combined circulation of 18,07,38,611. Out of 8512 newspapers, as many as 6686 were owned by Individuals, 1122 by Joint Stock Companies, 260 by Societies and Associations, 222 by Trusts and 150 by Firms and Partnerships. 41 newspapers were brought out by the Central and State Governments. Cooperative Societies, Educational Institutions and the like, owned the remaining 31 (RNI, 2006). According to National Readership Survey 2006, press reach has stabilized in urban India – at 45% with 110 million readers. Press reach in rural India has also stayed the same at 19% with a readership of 112 million. Indian reader spends 39 minutes daily on an average per day. But there has been increase in urban India (from 41 to 44 minutes daily) and decrease in rural India (from 36 to 35 minutes daily) (NRS 2006).

Literature Review

Various researchers have investigated research news (R.N.) from different perspectives. Dutt & Garg (2000) found that The Pioneer , The Hindu , and The Times of India together devoted about 23 percent of the total space to items on science and technology. The sources for most of the articles (97 percent) on policy issues originated from within India, while for other stories foreign sources, including those from the United States and the United Kingdom, also contributed. Indian newspapers devoted far less than one percent of the total printed space to articles and stories related to science and technology. Entwistle (1995) reported that in medical research, journalists were more likely to cover currently topical subjects; common and fatal diseases; rare but interesting or quirky diseases; those with a sexual connection; new or improved treatments; and controversial subject matter or results. The journalists stressed that medically worthy information is not necessarily newsworthy. Koren & Klein (1991) argued that the number, length, and quality of newspaper reports on the positive study were greater than news reports on the negative study, which suggests a bias against news reports of studies showing no effects or no adverse effects. Bartlett, Sterne & Egger (2002) found that Newspapers underreported randomised trials, emphasised bad news from observational studies, and ignored research from developing countries. Good news and bad news were equally likely to be press released, but bad news was more likely to be reported in newspapers.

Objectives

1. What is the extent of research news in newspapers?
2. What are the various types of research news published?
3. What is the relative contribution of newspapers in publishing research news?
4. What kind of placement is accorded to the research news?
5. What are the different sources of research news?
6. Who are the countries whose research is reported?
7. What is the amount of space provided by newspapers to research news?
8. What is the relationship between the sources and inventing countries?
9. What is the relationship between newspapers and other variables?

Research Design

The researcher applied the quantitative content analysis technique to fulfill the objectives. Content analysis may be defined as a methodology by which the researcher seeks to determine the manifest content of written, spoken, or published communications by systematic, objective and quantitative analysis (Zito, 1975, p.27)

Newspaper selection: Three highest read English dailies (The Times of India, The Hindu and Hindustan Times), one regional daily (The Tribune) and one financial daily (The Economic Times) were taken in view of their high circulation and rainbow characteristics of regional and content diversity. TOI with circulation 11,02,521 and readership of 7.4 million, The Hindu with 11, 68,042 circulation and 4.05 million readership, HT having circulation of

113644 and a readership of 3.85 million are the three largest nationally circulated and read newspapers. The Tribune has the highest circulation with its regional flavour Haryana and Punjab regions. The ET has highest circulation among financial dailies and coverage of R.N. related to Business, management, finance etc. necessitated its inclusion.

Unit of analysis: The news headlines which consisted of words like ‘study’, ‘research’, ‘report’ and ‘survey’ were taken as unit of analysis.

Hypotheses: Types of R. N. is dominated by medical science to a large extent.

Findings and Discussions

Extent of research news

A sum total of 182 R.N. appeared in 150 editions of 5 newspapers (Table 1). The largest read Indian English daily TOI published maximum (34%) R. N. followed by The Hindu (23%), The Tribune (32), HT (14%) and ET (11%). There is an evidence that the newspapers with highest readership publish high number of R.N.

Types of R. N.

R. N. in newspapers were categorised as natural sciences, social sciences, business & mgt and IT. Natural sciences topped the chart with 67% score (Table 1). Hence the hypothesis of a big chunk of R.N. having medical science research is accepted. A random search on www.scholar.google.com and other search engines throw numerous studies on reporting of medical research whereas very little is available for other research types. Social science research came next (21%) with business & mgt. (7.7%) and IT (4.4%) categories.

In a newspaper wise analysis, The Hindu published maximum (50%) R. N. relating to IT among all newspapers. It had maximum (66%) natural sciences R.N. followed by social sciences (19%), business & mgt (5%) and IT (9.5%).

TOI put slightly more emphasis on natural sciences than social sciences followed by business & mgt and IT. It had 50% less coverage of IT R.N. as compared the The Hindu.

HT didn’t publish any R.N. relating to IT and business & mgt. It only had social sciences (31%) and natural sciences (69%) R.N. ET, emerging true to its name, had maximum R.N. on natural sciences (60%) and business & mgt (20%). A clear slump was seen in case of social science R.N. HT and The Tribune didn’t have any R.N. on IT.

Table 1. Types of research news

Newspaper Total					
Research categories type	The Hindu	Times of India	Hindustan Times	Economic Times	The
Tribune					
Natural sciences	28 (23)	42(34.42)	18 (14.75)		12 (9.83)
22(18.03)	122(67.03) Social sciences		8(21.05)	14(36.84)	8
(31.05)	2 (5.26)	6(15.78)	38(20.87) Business & management		
2 (14.28)	4 (28.57)		4 (28.57)		4 (28.57
14 (7.69) IT		4 (50)	2 (25)		
2 (25)		8 (4.39) Total			
42(23.07)	62(34.06)	26 (14.28)	20 (11)		32(17.58)
182(100)					

Placement of R.N. in pages

In order to ensure the meaningful categories of pages, the categorisation identified by Bansal (2002) was adopted with slight modifications (Table 2). Among all pages, it was found that maximum (25%) R.N. appeared on national pages of the newspapers. This is indicative of nationwide spread and reach of R.N. which was exposed to the maximum number of readers unlike other pages where regional customisation factor is at play. Business page had 2nd maximum (19%) R.N. followed by last page (17.5%), 'other pages' (13%) and front page (12%). The 'other pages' included regional news pages, special column pages etc. The editorial page and sports pages had equal share of R.N.

(6.5%). The editorial columns mainly commented on the R.N. published mostly on the previous day and rarely on the same day.

Table 2. Placement of R.N. in pages

Newspaper Total					
Pages	The Hindu	Times of India	Hindustan Times	Economic Times	The
Tribune					
Editorial	2(16.66)		6 (50)		
2 (16.66)	2(16.66)	12(6.59) Front			
10 (45.45)	8 (36.36)		4 (18.18)		
22(12.08) Business		20 (58.82)	4 (11.76)		
4 (11.76)	6 (17.64)	34(18.68) Sports	10(83.33)		
2 (16.66)			12 (6.59) National		
2 (4.34)	28 (60.86)	4 (8.69)	2 (4.34)		
10(21.73)	46(25.27) Last	20(62.50)			
8 (25.00)	4(12.50)	32(17.58) Other pages	8 (33.33)		
4 (16.66)	2 (8.33)	4 (16.66)	6 (25)		
24(13.18) Total	42 (23.1)	62 (34.06)	26 (14.28)		
20 (11.00)	32(17.58)	182(100)			

In newspaper wise interpretation of data, extreme distribution of R.N. spread across various pages was observed. It was revealed that The Hindu didn't have any R.N. on front page and business page and had a negligible (5%) R. N. on national page. It had maximum (24%) R.N. on sports page followed by last page, other pages and editorial page. It is evident that the newspaper selected premium pages to publish R.N.

Distribution skewness was slightly less in case of TOI which didn't have any R.N. on editorial page, sports page and last page. It published maximum (45%) R. N. on national page followed by business page (32%), front page (16%) and other pages (7%), all very important positions.

The distribution spread of R.N. in case of HT was equal across all the pages except last page which is sports page. HT had maximum editorial inclusions (50%) on R.N among all newspapers. followed by front page (31%), sports page (8%) and business page (15.4%). Editorial page is regarded as heart of newspaper and front page commands maximum OTS (opportunity to see). ET had maximum (40%) R. N. on last page. The R.N. spread across editorial, business and other pages was slightly more or less equal.

The Tribune had a symmetrical distribution of R.N. spread (none in case of sports page) vis a vis other newspapers. 'National page', business page had first and second place respectively, having highest share whereas rest all of the pages had spread in equal amount.

News sources of R.N.

Correspondents & staff reporters were the biggest source having around half (44%) share of R.N. published in newspapers (Table 3). News services/news networks and news bureaus (Times news networks, ‘by our news bureau’, Tribune news service etc) occupied 2nd position with 16.5% share. Among foreign news agencies, British agency Reuters contributed maximum (10%) followed by French agency AFP (Agence France-Presse) having 7.7%, Associated Press (AP) of America (6.6%) and ANI (Asian News International) with 6.6%. Indian agency PTI (Press

Trust of India) had a commendable share (7.7%) at par with AFP and even more than ANI. Only two R. N. didn't have their source mentioned. This finding points towards the onus and indispensable role of journalists in promoting scientific thinking in masses by writing maximum possible R.N.

Table 3. News sources of R.N.

Source Newspapers				Total		
	The Hindu	Times of India	Hindustan Times	Economic Times	The Tribune	
PTI				6 (42.85)	2 (14.29)	
6(42.86) 14(7.69) Reuters				8(44.44)	10(55.55)	
18(9.89) Correspondents		16(20)	22 (27.50)	22 (27.50)		
14 (17.50)	6 (7.50)	80 (43.96) AFP				12(85.71)
2(14.29) 14(7.69) AP				6 (50)	2 (16.66)	
4 (33.33)			12(6.59) News networks & bureaus			
20 (66.67) 2 (6.66)				8(26.66)		
30(16.48) Not mentioned						
2 (100)			2 (1.10) ANI			
2 (16.67)					10(83.33)	
12 (6.59) Total			42(23.08)	62 (34.07)	26 (14.29)	
20 (10.99)	32(17.58)	182(100)				

In cross sectional tabulation analysis between newspapers and sources, it emerged that The Hindu was frontrunner in publishing R.N. from correspondents followed by AFP, Reuters, AP and correspondents & staff. It didn't publish any R.N. from PTI and news networks & bureaus.

TOI, while respecting the trend, went further selective in utilizing agencies. It depended heavily on its own journalists (35%) and news network (TNN) to publish maximum R.N (32%). (rather TOI's dependence was highest (44%) among all newspapers). It also used Reuters and PTI to a great extent (16% & 9.5% respectively) and AP & ANI to the lesser extent.

HT relied heavily on its journalist for the R.N.(84%) They wrote maximum stories for the newspaper. It used negligible (7.7%) R. N. from PTI and news network & bureaus (7.7%). HT published 50% (maximum among all newspapers) of its R.N. in editorial columns which clearly reflects its editorial stance.

ET was the only newspaper which had not mentioned the source in two of its R.N. Perfectly towing the pattern line, its correspondents wrote down maximum R.N. followed by AP.

A very different scenario of pattern emerged in case of The Tribune, which contrary to the prevalent trend, had highest number (31%) of R.N. from ANI followed by PTI (19%). Its journalists wrote least number (7.5%) of R.N. among all newspapers.

Regions of Research

Asia region was ranked first with 42% share of R.N (Table 4). This region comprised India, Malaysia and Japan whose researches were reported. North American (27%) trailed the Asian region which included mainly US and Canada. Europe came 3rd (21%) in hierarchy with maximum entries from UK and one each from Germany, Switzerland, Sweden and France. Various agencies of United Nations mainly WHO (World Health Organisation) also came out with 6.6% of total R.N. An unhealthy trend of not mentioning the country was noticed in case of few R.N. The only region lagging far behind others was South America (.54%) where

Table 4. Regions of research

			Newspaper			
Total Regions		The Hindu	Times of India	Hindustan Times	Economic Times	
The Tribune North America		13(26.53)	18 (50)	2 (4.08)		6
(12.24)		10(20.40)	49 (26.92) South America	1 (100)		
1 (0.54) Asia		12(15.78)	24 (31.57)	16 (21.05)		
10 (13.15)		14(18.42)	76 (41.75) Europe		14(36.84)	10
(26.31)	4 (10.52)		4 (10.52)	6 (15.78)		38 (20.87)
UN/WHO			8 (66.66)	2 (16.66)		
2 (16.66)	12 (6.59) not mentioned		2 (33.33)	2 (33.33)	2 (33.33)	
6 (3.29) Total		42(23.07)	62 (34.06)	26 (14.28)		20

(10.98)	32(17.58)	182 (100

only one R.N. from Chile could make it to the newspapers.

Inventing countries

In the list of inventing countries, Indian research studies were reported maximum (39.5%), see (Table 5). US research reporting came next (23%) trailed by UK (18.7%), UN/WHO (6.6%), Europe (2.2%), Malaysia (1.1%) and Japan (1.1%). United Kingdom has been separately shown from European owning to its 34 R.N. as compared to only 4 in case of other European countries. Worldwide, mostly US research is cited by researchers but the trend of rising dominance of regional research (Indian) instead of transnational one (US, UK etc) is certainly a welcome step.

Table 5. Inventing countries

Inventing countries Total					Newspaper	
	The Hindu	Times of India	Hindustan Times	Economic Times	The Tribune	
US		12(28.57)	14 (33.33)	2 (4.76)		4
(9.52)	10(23.81)		42(23.07) Canada			2 (25)
4 (50)			2 (25)			
8 (4.39) Europe		4 (100)				
4 (2.19) UK			10(29.41)	10 (29.41)	4 (11.76)	
4 (11.76)	6 (17.65)		34(18.68) India			10(13.89)
24(33.33)	16 (22.22)	8 (11.11)		14(19.44)		72(39.56)
Malaysia		2 (100)				
2 (1.09) Japan						
2 (100)			2 (1.09) UN/WHO			
8 (66.67)	2 (16.67)				2 (16.67)	
12 (6.59) Not mentioned		2 (33.33)	2 (33.33)	2 (33.33)		
6 (3.29) Total			42(23.08)	62 (34.07)	26 (14.29)	
20 (10.99)	32(17.58)		182 (100)			

The inventing countries versus newspapers cross tabulation revealed that only ET had two R. N. from Japan and all of its research news had country mentioned like The Tribune. Only The Hindu published European research. ET and The Hindu didn't publish any research done by UN/WHO. Only US, UK and Indian research was covered by all newspapers whereas coverage pattern is not uniform for other countries' R.N.

The Hindu had more R.N. stories from US (28.5%) followed by UK (24%), India (24%) and Europe (9.5). The TOI turned out to be more patriotic by publishing highest Indian (38%) and US (22.6%) R.N. HT also trod on the dotted lines of TOI with highest Indian R.N. (62%) and exactly same pattern was noticed for ET and The Tribune. Every newspaper except The Hindu published highest Indian R.N. first and US research was accorded 2nd position except HT which gave 2nd place to UK R.N.

Space provided to R.N.

Table 6. Space provided to R.N.

	size in sq cms		
% The Times of India	9359		
30.0			
The Hindu 27.0		8542	
The Tribune		5899	19.0
The Hindustan Times	3883		12.0
Economic Times	3570		12.0
Total 100.0		312534	

Table 7

Mean space		
The Times of India		167.1
The Hindu		203.4
The Tribune		173.5
The Hindustan Times		161.8

Economic Times	178.5

The Table 6 & 7 clearly show space provided by all five newspapers in square centimetres. The total space provided by all five newspapers was 31254 sq cms. TOI provided maximum space followed by The Hindu, The Tribune, HT and ET. Barring The Tribune, the quantum of space is in perfect accordance with the readership of all four newspapers. Also, the frequency of contribution of newspapers is in perfect sync with the space provided by each of them. However, irregular pattern was observed in case of mean space. The Hindu and ET had provided comparatively high mean space to R.N. (Table 7). In simpler terms, it means that despite having less numbers of R.N. these newspapers provided good space to them vis a vis others having more R.N. and less space.

Conclusions

A strong positive correlation was found between the amount of R.N. and readership of newspapers. Barring The Tribune, there exists a very strong positive correlation between the readership and space provided to R.N. hence a trilogy of correlations goes like this: higher readership is correlated to higher number of R.N. and higher space. However, in a contradictory scenario, Mean space given to R.N. was higher for small readership newspaper like ET and The Tribune vis a vis others which translates into less number of R.N. but higher high print space.

Finally, it can be concluded that although one R.N. on average was published daily but it is highly inadequate to educate masses about science. This needs to be increased. Moreover, big number of medical researches and other natural science researches were highlighted discriminating others. Other types of researches should also be highlighted so that a holistic scientific temperament can be nurtured. Mere appearance of R.N. will not suffice for development and sustaining of the science communication rather those R.N. should be encouraged more which audiences can use to scientifically solve their problems themselves. More such studies covering research from various perspectives and dimensions are needed to contribute more to this area.

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177. Science Blogs in China: Exploring in the Forefront of Promoting Public Understanding of Science

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Abstract. As a new scientific community force, science blogs are playing a more and more significant role in science communication by exploring in the forefront of promoting the public understanding of science. Based on the analysis of the development of science blogs and their features, this presentation focuses on why and how science blogs can affect the public understanding from dimensions of the communication model, content(scientific affairs), information sender(scientists), and receiver(the public). I will also discuss the trend of science blogs in the coming world of information. Carried by science blogs and mass media, a new scientific communication ecosystem is forming.

Keywords: Science Blog; Public understanding of science; Science blog circle; Scientific communication

Twenty-five years ago, the Public Understanding of Science published by the United Kingdom's Royal Society argued that scientists must learn to communicate with the public and consider it their duty to do so. For decades, scientists have been making great efforts on promoting public understanding of science through the traditional mass media. Now, scientists have begun reaching out to mass audiences through blogs, by which they could communicate with the public more conveniently.

Science blogs were favored by the scientific community with the unique advantages of open, fast, interaction and efficiency. Scientists from University of Oxford held that science blogs can provide a unique educational bridge between academia and the public and distill important experimental findings into an accessible, interactive format. And the author suggested that we should create mechanisms for institutions to provide appropriate (but not stifling) oversight to blogs and to facilitate high-quality interactions between blogs, institutions, and readers[1].

And now, Science blogs have formed influential online group power with the development and mature of blog technology in China.

The Rise of Science Blogs in China

As early as in 2006, science blogs have been basically alone in China. A reporter from the China Youth Daily wrote in a report that a science reporter wanted to understand the current thoughts of scientists through the science blogs, but he only found two science blogs through the Internet. One of them belongs to Li Miao, a researcher at the Institute of Physics of CAS. Another is Wei Yu, who is an academician of Chinese Academy of Engineering.

Four years later science blogs have developed rapidly in China. A large number of scientists, such as Zuoxiu He, Yigong Shi, Yi Rao, Nanshan Zhong etc., are expressing their views and thoughts on science through the science blogs.

It's gradually found that those science blogs always belong to a website or several websites. The science Blog Circles have gradually thrived following the boom of the individual science blogs.

Sciencenet (http://www.sciencenet.cn/blog/), one of the most popular science blogs in China, began in 2007 and now attracts over 4,000 bloggers setting up sciences blogs and thousands of visitors. The blog aims to construct the first media of blogs circle for the global Chinese scientists. In the blog community of Sciencenet, most of bloggers are the scientists in different fields of nature science, who have always expressed their views and thoughts on the science affairs.

Another popular science blog circle is Songshuhui (http://songshuhui.net) set up by a group of science amateurs in 2008, which was awarded the Best Weblog and the Best Chinese blog in the fifth BOBs. Most of the bloogers are science amateurs. The aim of it has been vividly described as knocking the hard shell of science and helping people enjoy the inside of science. Different from the Sciencenet concerning about the thoughts of scientists, Songshuhui devotes to the creation of science popularization works.

1 Shelley A. Batts*, Nicholas J. Anthis, Tara C. Smith. Advancing Science through Conversations: Bridging the Gap between Blogs and the Academy. PLoS Biol 6(9): e240. doi:10.1371/journal.pbio.0060240.

Aiming at promoting academic innovation and science communication, it is worth mentioning that the first National Blog Contest in China, held by China Association for Science and Technology in 2009, has successfully promoted the great development of science blogs in China. It was reported that there were 1279 blogs participating in competition, which are from 40 sites and 8 independent domain name blogs, and the participants included 106 Doctorates, 88 masters, 117 professors, 105 researchers and 55 senior engineers. And then the CAST (http://www.cast.org.cn) set up a section about Science Blogs to spread excellent blogs from Websites.

Until now, science blogs have been developing and coming to form strong social effects in China.

New Strength for Science Communication

Professor Annian Huang, who set up website for academic exchange before (www.annian.net), now established his science blog in Sciencenet, keeping the highest personal records including 4,942 blogs, 5180,000 visits and 4,043 commentaries (Searched on August 18, 2010). Professor Huang said in Why I established a blog in Sciencenet that my website can't communicate with the public until now, but the blog can. It is a good form for expression of views and communication with the public.

Just as same as Professor Huang, more and more scientists who wouldn't like to contact with the media before recognize the potential value of science blogs now. They use to express themselves through science blogs little by little.

Science blogs provide a free and independent space for scientists. There actually are not enough channels from science researches to science news because of the immature science communication system in China in the past. The reports of academic conferences and the academic achievements are the common parts of science communication, which attract scientists and the public no longer.

Compared with it, what kinds of issues on earth do the scientists discuss through science blogs? We studied the science blogs community of Sciencenet, which is a large group of scientists. Eight kinds of issues are mainly discussed.

i. The Current Affairs about Science, Such as Nobel Awards in 2010

ii. The Science and Technology Policy by Chinese Government, Such as 1000-Elite Program

iii. Discussion on the Science and Technology System at Home and Abroad

iv. Commentary on Science Culture, Such as Anti-corruption of the Academic

v. Exchange of Academic Research

vi. Communicating with the Public, such as the Works of Science Popularization

vii. Communication of Teaching Between Teachers and Students

viii. Scientists Valuable Personal Experiences in scientific life and everyday life.

Those issues are involved in the majority of their discussions. It's obviously that science blogs build new platform for scientists, which enable them to enter the media system directly and participate in the science communication as independent information senders. As the sources of scientific understanding, scientists take the duty to communicate to the public more fully through the forms of we-media and hold higher authority and reliability, which is beneficial to delivering better communication results.

We took the 1000-Elite Program as an example, a hot topic in resent two years in China. I searched 61 blogs in Science blogs community of Sciencenet on July 13, 2009, by using the key word 1000-Elite Program. Most of blogs were written by the front-line scientists and researchers, by which visitors could grasp the views on the program. Supporters and doubters had expressed the fresh ideas and even intense argument. Actually, it's hard to get this information through the traditional media. The public can understand the true thoughts of scientists and development of scientific issues.

The different between the traditional science communication and science blogs is just like the differences between 2D and 3D of Video. The public could deeply understand science and technology though the 3D world that was constructed by science blogs with the features of open, fast, interaction and efficiency.

Science blogs have changed the traditional form of science communication and provided new sources and channels for the public to understand science and technology, which play the role of guiding public opinion and promoting public understanding of science and technology attitudes in the context of low science literacy and a serious shortage of scientific information in China.

New Explorations of Science Blogs

Science blogs has changed the traditional made of science communication. Scientists directly enter the medium of science communication system and become the information sender through blogs, which showing the strength of we-medium. Does it mean that the Science blogs are perfect? The answer is no. New explorations of science blogs are carried out.

Real-name system

Science communication depends on the authority and reliability of the materials of science news. While blogs provide open platforms for bloggers, and freedom is the best character. Contradictions between the rights and responsibilities are difficult to deal with.

Based on the rules of authority and reliability, real-name system is used in the registration by science blogs community of Sciencenet. Sciencenet holds that the nature of science is the pursuit of truth. Science bloggers have the duty to be responsible for what they write.

Although the volumes of blogs are relatively small after real-name system carried out, the volumes of visits are fairly large. The views and thoughts of well-known bloggers have further enhanced the authority of science blogs, even have had great social impacts.

Combined with traditional media

A senior reporter in Nature Science held that journalism is in decline, science blogging is growing fast. Can the one replace the other?[1]

In China, it is premature that science blogs can replace traditional journalism. As a new and helpful media promoting public understanding of science, science blogs have combined with traditional media.

More and more traditional journalists are increasingly looking to these blogs to find materials as news topics. In Sciencenet, A net community is forming through science blogs that have more influence than before. Journalists and scientists connect more conveniently.

Some blogs written by scientists have been published in the traditional media. Science and Technology Review, organized by the China Association for Science and Technology, set up the column of Science Blog, in which the excellent blogs was published.

Carried by science blogs and mass media, a new scientific communication ecosystem is forming. Xingdong Fang, father of the Chinese blogs pointed out that Mass communication is a typical cathedral model, and blog communication is a typical bazaar model. A new communication ecosystem dominated by mass communication and blog communication will be gradually formed in society, which will affect on the Internet, media, life, political, economic, social, cultural and other aspects.

The development and innovation of modern communication is providing communication platform between scientists and the public and promoting the public understanding of science. As a reporter pointed out in Nature that in today's overstressed media market, scientists must change these attitudes if they want to stay in the public eye. They must recognize the contributions of bloggers and others, and they should encourage any and all experiments that could help science better penetrate the news cycle.[2]

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178. A National Channel Devoted for Science Communication (NCSC)–Need of the Day

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Abstract. India is a vast country with a wide diversity of language, traditions and culture. A large number of activities are undertaken for popularisation of science among different sections of the society. Significant amounts are being spent for these programmes. The advances in science and achievements in technologies at the National level are highly commendable. All these can reach the people, if properly pooled, suitably edited and beamed in the electronic media through a National Channel for Science Communication (NCSC), especially devoted for this purpose.

Keywords: Astronomical Events, Electronic Media, Flexitime, National Channel, NCSTC, Print Media, Science Centres, Science Express.

Introduction

Under the NCSTC banner a large number of activities are undertaken throughout the year in different parts of India to popularize science. Besides, there are various organizations, institutions, individuals and groups who have their own programs to take science to the common man. Particularly, schools and colleges organize various activities, including popularization of science on occasions like Annual Day, Foundation Day, Cultural Week, National Science Day, Technology Day, World Environment Day etc.

At the National level, we have National Children Science Congress, Indian Science Congress – a large part of which is aimed at and relevant to the common man. Mention may be made about the programmes of Science Centres under the National Council of Science Museums. Similarly the RVPSP under DST organizes the Science Express in collaboration with Foreign Societies. There are also major events like successful launching of Chandrayan-1; it's continuing sojourn and landing on Moon, future program of experiments to be conducted; participation of team of Indian Scientists in the experiment on Large Hadron Collider, by far the greatest scientific experiment ever conducted in the world.

Whereas in the former events the activities are confined to visitors and participants, only a few columns are covered in print media and a few minutes of TV coverage reaches the other areas and common public. The latter events are mostly covered in the print and electronic media only as NEWS ITEMS.

Very often the curiosity of the children and public is not satisfied in this process. It is true that some interesting events are brought out as articles in some magazines – more often devoted for other purposes. Some are available on internet to which only a lucky and privileged section have access.

Objective

A National Channel of Door Darshan devoted for programmes on Science & Technology appear to be a pragmatic solution for taking Science and Technology to everyone.

Observation / Discussion

For a moment let us consider some channels presently operating in other countries. NASA channel continuously beams programmes related to Space activities, both current launches and past programmes, trainings, seminars, talks, interviews and so on. Similarly National Geographic, Discovery channels have a lot of science components. These are costly and production of programmes of such quality and depth may be out of reach for us at present.

We should do justice by adding that some of the programmes of the foreign channels like 'Discovery'& 'Animal Planet' etc are now available in Hindi. I would still consider them as supplementary provision.

But considering activities related to SCIENCE COMMUNICATION, currently going on in different parts of our country, these can certainly be beamed in a channel devoted for this purpose. All that one has to do is to co-ordinate and pool them – if not make it mandatory to convey the recordings in e-media - to a central point, edit them by an expert group and beam them in the channel.

In our country we have enough talents to communicate Science in a number of INNOVATIVE WAYS which does not reach many corners of our vast country and its heterogeneous public.

Thanks to NCSTC, already the methods of communication have been standardized and are popular. Similarly, technologies are available for rendering texts in one language to any other Indian language.

Crores of rupees are spent, in our effort to communicate science, for production of software which remains confined to limited regions and becomes only a ritual. On the other hand if the details are beamed in a National Channel more people will be benefited.

I quote below some reports, views and reviews on Science communication published in newsletters and books.

"Why Science Communication

"Science Communication Programmes and Activities have an important role to play for developing a scientifically informed and attitudinally rational society, by way of interpretation of scientific knowledge and scientific concepts to the public through different mass media-Print, Broadcast, Folk, Interactive or Digital, sustained Science Communication efforts play a key role...."

"The Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad established in 1982 undertakes a broad spectrum of activities concerning S&T communication targeted at various segments of our society laying emphasis on..."

"Reaching people using all possible media both traditional and modern and by employing software in their own language."

The third independent review held in 2001-02 assessed about 25 programmes of the Parishad. (I refer to only a few concerning TV).

- Kudratnama–A popular science TV quiz for school children-27 episodes
- A TV series titled Vigyan Ki Rahein –under Krishi Darshan
- Collection of data from organisations engaged in S&T popularisation in Delhi and Haryana.
- National Children Science Congress, since 1997.
- National Science Day celebration spread over a month.
- Country–wide programmes for Scientific Awareness and safe observation of total Solar Eclipse on 24.10.1995 and 11th August 1999." Let us take the case of National Children Science Congress. It has become almost a mass movement (students).

But think of the larger mass of students in remote corners, who have neither been able to participate nor have an exposure of the apex level. Think of what would be their joy and benefit if they are shown a glimpse or more of the programme, exhibits, presentations etc.

Take another case of Science Express. It would be relevant to quote the views of Mr. Chander Mohan.

"Science Express is an innovative Science Exhibition mounted on specially designed train. This state of the art exhibition will cover about 17,000 kms over six months and halt at 51 Railway Stations.....The major objective of this unique venture is to nurture curiosity amongst our youth and rekindle their interest in science."

This programme is being repeated very often, almost every year, in collaboration with foreign institutions. The contents are simply superb, stupendous, awe inspiring, highly educative and valuable. One laments to think of the large of student population and public who are deprived of a closure look, if not physically, at least by other audio–visual media. In fact, one would go further and say that a mass briefing before the express reaches the station would be highly beneficial to the visitor for understanding and appreciating better. A TV channel proscribed for Communicating S&T, I hope will serve the best interest.

Regarding efficacy of Mass Media like Radio, the author has experience in one such event. Way back on October 24, 1995 there was a major Astronomical Event viz; Total Solar Eclipse (TSE) viewed in India. Elaborate arrangements were made in the Pathani Samanta Planetarium (PSP) premises for observing TSE. In addition, PSP collaborated with AIR, Cuttack to arrange for a "running commentary" of the event as it progressed in different locations in India. It was interspersed with scientific information related to the event. This created not only interest about the event as a "Natural Phenomenon" in the minds of the people in the remote corners of Orissa but also helped in dispelling superstitions and blind beliefs about TSE. Just imagine what would have been the effect had it been telecast in TV with running commentary!!

Felt Need of TV Channel

For communicating Sc & Tech the acute need of a TV channel has always been felt. To quote Mr. Subir K.Sen

3 "Science shows & documentaries are another very important communication mode for science. Unfortunately we do not have any TV channels or slots in any channel for transmission of indigenous Science Technology & Industries (STI) matters. Our interested persons or viewers are to satisfy themselves from foreign CD's and channels such as

Discovery, Animal Planet & BBC. I know of the nice science program in English by Mr. Samir Bagchi and team, serialised in National Network of

Door Darshan..... Cannot we have some arrangements for knowing existence of such items and see them if need be."

Thus our Elite people, Scientists and Technologists, over the years, have always expressed the need of a TV channel of Science, devoted for Science and Science alone.

Inference

The advantages of Television are:

- TV is audio – visual
- TV can reach more people simultaneously.
- It is flexitime.
- Programs can be available and expected in one particular channel.
- NCSC can be an alternative to channels meant for "Entertainment" and 'News' about which much can be said.
- Production cost would be minimal as many of the programs to be beamed are / would be available in e-form having been prepared at various locations.

Conclusion

The role of Print Media, Radio or other e-media cannot be underestimated. However the advantages of Television appear to be enormous, considering the mobility and other modern technologies by which the communication can reach every individual.

In India's perspective, considering its diversity of population, locations, languages, cultural backgrounds, on one hand and technologies available, money being spent for current programmes and economic viability on the other hand, the national channel has immense potential.

Recommendation

Hence we should recommend for setting up A National Channel For Science Communication (NCSC) under the aegis of Door Darshan. It would be relevant to mention that Door Darshan is not a paid channel. Hence NCSC can be made to be freely available through all cable operators.

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179. Science Communication through Mass Media: Coverage of Science in Tamil Satellite Television Channels

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Abstract. According to Harold Lasswell, one of the important social functions of the media is providing information about events and conditions in society and the world. Also it should facilitate innovation, adaptation and progress by providing information. So Media has an important role in disseminating science and technology related issues to the people.

India witnessed media revolution in the nineties. The media world was revolutionized by the technology advancements, liberalized policies of Indian government, burgeoning of media houses and commercial objectives. Particularly the television medium developed a lot.

It is significant to study the role of Tamil television channels in science communication. Thanks to the number of Tamil television channels, we watched the launching of satellites; solar eclipses; scientific advancements. So we can have a quick look on some of the programmes of television channels which focuses on science and technology.

The purpose of the present study is to find out the coverage of science in Tamil satellite television channels; this research addresses the following questions. What is the extent of science coverage in Tamil satellite television channels? What are the content characteristics of science content in Tamil satellite television channels?

The present study employed qualitative method to study the coverage of science in Tamil satellite television channels. The researcher used observation method for the study. The data revealed that Tamil satellite television channels gives less importance to science and technology content. Sun TV, Chutti TV, Chittiram TV and Makkal TV have allotted time for regular science and technology programme. Most of the science content is in the form of discussion, puzzles, quiz, stories, and demonstration. The content also includes pictures, illustrations, animation, graphics and colorful photographs. Hence, some of the Tamil television channels are concentrating on science and technology. But they are very minimal.

180. Coverage of Science & Technology in Indian Newspapers: A Content Analysis Approach

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Abstract. Science communication has become essential for the development and prosperity of any nation. In the country like India where superstitions still prevails and hinder all the efforts of developments, science illiteracy cannot be ignored. It is required to put utmost efforts to make people scientifically aware, by informing, educating and explaining them about science and technology. Media can play a tremendous role in disseminating scientific information in interesting manner. Numerous research studies has been conducted in India and abroad to find out the coverage of science and technology in media which reveal that the amount devoted to it is very substantial. Present study focuses on the amount of space given to science and technology in national newspapers, comparison of coverage in Hindi and English newspapers, and the format being used in disseminating information. Research also focuses on the preferences to the subjects on which newspapers present more information and the sources of information whether Indian or foreign. The research methodology which is used is content analysis.

Keywords: Science, Technology, Communication, Coverage, Newspapers, Space +

181. Scientific Temper, Science Communication and Print Media

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Abstract. Scientific temper may be considered as a state of mind and behavioural outlook where a citizen undergoes an organic transformation with scientific awareness accrued through various channels of scientific communication. The attainment of scientific temper is a pre-conduction for the development of any society. In traditional societies like India, the communication of science was poised by print media during the yester-years. But the advent of visual media poised a severe challenge to print media when the print concentrated more sensationalism, crime, politics and cinema, providing only less importance to science. The print media can again become an effective tool for science communication by solving various problems with respect to scientists, and science communicators.

Keywords: Chain reaction, Deadline, Interpersonal communication, Ivory tower approach, Mass communication, Media mix, Peer-review, Public awareness, Science communication, Scientific temper, Three pillar theory

Towards Scientific Temper

Scientific temper is an attitude of mind which calls for a particular outlook and pattern of behaviour. It is neither a collection of knowledge or facts, although it promotes such knowledge and rational thinking. Creation of scientific temper is more a matter on the social agenda than on the scientific and technological agenda. Hence its impact with respect to any traditional society is much greater than the spread of science and technology

Creation of scientific temper is not synonymous with mastering of science and technology or developing a highly industrialised society. It is rather an attribute of human mind and of social decision making process, than knowledge of various branches of science. The inculcation of scientific temper in our society would result in our people becoming rational and objective, thereby generating a climate favouring an egalitarian, democratic, secular and universal outlook. Hence it should become a part of human culture, a philosophy and a way of life which leads to pursuit of truth without prejudgement.

People must be involved in the process of science. Public awareness and understanding of science and resultant public participation in the debate on issues of science, technology and environment having societal impact is a prerequisite for development and hence became very important for the progress of any society. That may be the reason why democratically elected governments all over the world is actively thinking on appropriate strategies to instil scientific temper in traditional societies. Only with the active involvement of the mass media, this onerous task could be undertaken. Unfortunately the mass media generally adopt an attitude which encourages an irrational outlook and thus become a stumbling block in the path of creating scientific temper.

It is not an easy task to create scientific temper in the minds of people. Scientific knowledge and scientific information could be imparted through the effective use of media and other mass communication techniques. But scientific temper is a sort of mindset which is totally different from scientific knowledge and awareness. Propagation of science through mass communication and inter personal communication in a simple style on a continuous basis will pave for the creation of scientific temper. Hence science communication can be considered as a means to achieve the ultimate target, establishing of scientific temper among the grass root level of the society.

Studies proved beyond doubt about the impact of media moulding the views of a society. Mass media is considered as the most potent form of communication to popularise science. Communication of Scientific knowledge through media is generally considered as science communication. There are a number of modes of communication to propagate science like interpersonal communication, group communication, mass communication or digital communication. But in traditional societies where literacy, customs and beliefs prevail, the effective channel for communication is Mass communication, using mass media where the messages are reinforced by interpersonal efforts.

The process of mass communication is having proven abilities to interact with people with different colours, races and cultures settled in different geographical areas. Inter personal communication helps to reinforce ideas and beliefs transmitted by various means of mass communication.

Though the general impression is that the visual media which synergised with audio and video inputs have a greater impact on members of traditional societies where rate of literacy is high. The educated elite as well as the poor believe the power and credibility of print media. Print is the oldest medium of communication having a permanent format, longer storage life and an ability to cater the local communities. In a sense, it is interactive also. Further, print media has catered and is still catering science than other media and provide space to science and technology reporting in the past.

But the growth of visual media,raised a challenge to print media in reporting science and it is loosing interest in reporting science gradually, perhaps due to their growing attention to counter the emerging challenges of visual media. Journalists attributed the reason for this antipathy as the disinterestedness of readers. As in the case of crime, cinema and politics, there is no persistent demand from readers for science news. The failure to create such an interest is due to the lack of vibrant grass root level agencies. A joint effort of scientists, science journalists (communicators), and the readers who are the three pillars of science communication is needed to boost science coverage. These three pillars are interdependent, though seem to be independent.

In many countries, especially developed nations world-wide, the growth of, science communication has a direct link with scientific advancement, research activity and allied S&T progress. They are mutually dependent to a large extent. But there are exceptions to the general rules as in the case of Kerala which is a state in the Indian Union, having very high literacy level, where even journalists who shows disinterestedness to publish matters on scientific programmes on the pretext that their readers have no interest. But no serious media research has been conducted so far to prove the veracity of this point, or to test the veracity of the age-old myth. Kerala state is a classical sampling unit to conduct such research because it is the first state in India achieved 100 percent literacy. Besides Kerala is having an age old tradition of science communication through print media. The first science periodical, agricultural periodical and health periodical in any of the Indian regional languages were originated in Kerala in the regional language Malayalam during the beginning of 19th century.

While analysing the Kerala society as a whole, we have to come to a conclusion that the print media had played a yenon role in the social transformation in Kerala. The agricultural revolution as part of the Grow More Food campaign (in connection with the Green revolution) became a success, only due to the organised campaign of print media during 1950’s. The spread of health consciousness, sanitation and awareness in modern medicine including vaccination and application of antibiotics which increase the health expectancy of average Keralate is also due to the committed effort of print media. But when the visual media coupled with digital media reign the scene, the scenario the print media slowly withdrew from the area of science popularisation.

The ABC (Audit Bureau of Circulation) figures and readership surveys categorically asset the fact that print media commands a better influence and circulation in such traditional societies. Though the society depends the visual media for entertainments, the people are looking print media as the source of information on science, literature, arts and even politics.

The failure of creating scientific literary and scientific temper is due to the absence of vibrant agencies functioning in the society. Though the Government and other agencies are pumping a lot of money for propagating and popularising science, the grass-root level organisations including voluntary agencies have failed in their duty. The messages transmitted through the media would only be cemented with the help of interpersonal communication and group communication organised by voluntary agencies and committed and efficient science teachers. Unless the grass root level voluntary agencies are not functioning with a missionary zeal and social commitment, science popularisation would continue to remain as a distant dream.

Three Pillar Theory

Parliament, Executive, Judiciary and Press are known as the four pillars of democracy. These four estates are independent and interdependent. The synergy formed by the effective functioning of the four pillars is the basis of any healthy democracy. Similarly science communication also needs the synergy formed by the collaborative activity of the three pillars for its success. They are scientists, science journalists (communicators) and the readers. Synchronisation of all these three elements is the key for successful science communication through print media. This process can generally be concluded as the three pillar theory of science communication.

The non-interest of journalists in reporting science which is a recent phenomenon is due to the lack of a pressing demand from the readers and general public. It is the habit of Kerala society to read at least a newspaper in the early morning. They would usually react only if the issue reported is volatile and totally against the basic tenets of society. Since science reporting is generally cold and inert in the hands of an inefficient writer, as there is not much scope for such a reaction from the society. Unless and until there is a pressing demand from society or public, journalists or media management would not act. The pertinent question is why people are not keen on science and why they are not demanding for science in a palatable way from the newspaper which they subscribe.

Such a demand would be evolved only if the citizenry in general is well aware of the implications of science reporting. They do not know the way through which science transform their lives by lock, stock and barrel. Without a sense of scientific temper and awareness, we can't expect a positive and pro-active response from the society.

Lack of understanding and mutual credibility between the three pillars, will upset the noble intention of science communication for sustainable development and the ultimate result is the erosion of credibility. Concrete steps have to be designed to fill the lacunae created between the three pillars of science communication. Otherwise the creation of scientific temper among the masses would still remain a mirage, even though Kerala society is at the threshold of scientific development and the citizens have nearly-cent percent literacy. Strengthening the activities of science communicators and voluntary agencies are the need of the hour for propagating scientific thinking which ultimately prompt the media to devote more and more space for science news in their editorial-mix.

In the case of sports, cinema, crime and politics, the public awareness is so strong and the media cannot evade the responsibility of reporting such events. Omissions in the follow up of stories on hot issues will not be tolerated by the readers. Hence the media personnel are trying to provide even the minute details of such events with a pinch of sensationalism. Creation of scientific awareness is not an easy task. The genesis and development of awareness can be affected only through vibrant and grass root level organisations. The awareness will ultimately leads to scientific temper. The conclusion is the theory of chain reaction, where Poor Awarenes on science leads to zero science news which ultimately results to

zero supply of Science News. It is interesting to note that the growth of science coverage has become inversely proportional to the growth of literacy and scientific advancement in the typical literate society like Kerala. A media observer could well understand the fact that a sharp decline in the science coverage in print media occurred during the recent times when compared with the previous century in Kerala. The phenomenon happened at a time when science and technology are advancing by leaps and bounds. The literacy rate of Kerala at present is around 100 percent compared with a meagre 10-15 percent in the previous century. This paradox indicates a peculiar tendency in the print media scenario in areas like Kerala. Perhaps, the people are not demanding for science coverage and that may be the reason why journalists are not interested in science coverage.

There are many other reasons for the lack of science coverage other than the affinity for sensationalism, lack of mutual respect or erosion of credibility between science communicators and scientists. The lack of empathy among the journalists towards their target audience is another problem. Failure of a journalist to link his science reports with its impact on society is detrimental for his report. Journalists are generally not interested in logically analysing the scientific issues or contributing to the issues by way of research and reference. Even if some factual errors are occurred in science reports, the 'gate keepers' of the society are not interested in making corrections or providing interpretations to the needy public. The writers are not interested in simple writing by avoiding jargons. The lack of persons with scientific back ground and absent of regular science beat in newspaper offices is another problem. During the past century, newspapers were widely considered as a vehicle for social transformation and anything published in it were considered with great reverence and credibility. Unfortunately the media mix has changed and science is getting lesser importance. But readership surveys in traditional societies proved that the print is most potent medium in mass communication.

Problems with Journalists

It is generally believed that the reason for the lack of science coverage in print media is the non-interest of the journalists. Science reporting is time consuming and it needs more effort and research. A fairly good background in the area of reporting is also necessary. The process of science writing also warrants more attention rather than writing on crime, politics, cinema or culture which are comparatively easy to report. However, there are many more reasons attributed to the media allergy to science reporting.

The general criticism against journalists is their innate affinity towards sensationalism. It is attributed as a force with potential to boost readership and hence the circulation. The tendency may be considered as an effort to combat the increasing influence of visual media with all its entertainment channels. But science is a subject having less scope for sensationalism. Epoch making inventions are rare. However, journalists celebrate such scientific events with much fanfare and enthusiasm. The newspapers are ready to publish news and features on a commendable invention in science with due or rather undue importance. On such occasions every effort shall be made to simplify the matter by avoiding technical jargons and the news is presented with a lot of illustrations and comments if necessary. But the phenomenon is not regular and the scientists as well as journalists never tried to pursue the trail of such incidents in a continuous manner, thereby maintaining the scientific-tempo created with such events. If a joint effort could be mooted, we would have good, simple and interesting science coverage throughout the year in a sustainable manner. There is no regular science beat in majority of language newspapers.

Non-availability of journalists with proper science background and understanding to cover science and technology events is yet another problem. Journalists usually approach science reporting with a pre-conceived notion that the same is totally alien to them. So they are not ready to apply their logical mind which ultimately resulted in the publication of a bad report. Even if some persons have scientific bend of mind, they also ignore logical thinking, sense of interpretation and inquisitiveness in science coverage. People have a general tendency to ignore global issues like Global Warming or climate change on the presumption that such issues never affect them. The reason is the laxity of communicators in conveying the message in an appropriate format to the general public. Science journalists should take the pain to describe how such global issues would affect an individual (or his kith and kin) wherever he be.

Reporting day-to-day affairs like politics and crime are comparatively easy. It is somewhat routine too. Consider the example of sports reporting. In sports, the rules of the game are known. Change is only in the players and the places. But science is new and the situations as well as the players are changing always. Further, the details and implications of scientific developments are known only to a few and hence science coverage demands more effort. Scientists generate ever-newer knowledge and reporters should keep up with such developments. Research, reference and sometime interviews are necessary to make a good science story. Research is the systematic investigation and study of materials and sources for establishing facts and to reach conclusions. Hence it is cumbersome and difficult to achieve deadlines for a science reporter.

The general compliant about science news reports and articles is the excessive use of jargonised language. The reckless use of jargons, clichés and technical language in writing science for newspapers made the reader tired and distanced himself from reading such pieces. Tendency of making the news story complex and complicated kills the interest of subscribers in reading science. The tendency of making science news complex is due to the lack of empathy, rather than the so called inability of journalists to do research or reference.

If an error appeared in a science story, or something is misquoted or misrepresented, generally no newspapers in the regional language come forward to set matters right with correction and proper clarification, as in case of political or crime reporting. It may be due to the absence of genuine reactions from the scientific community or from less vigilant subscribers. Such mistakes may appear in plenty in science stories which erodes the credibility of popular science reports among the right thinking persons in the society.

The media people are not much interested in writing follow-up stories in science and technology. Journalists have a presumption that nobody in the society is interested in science reports. Most of the journalists are not even ready to think about the possibility of linking science reports with its social significance and its role in alleviating the miseries of the common man. An orientation and social commitment from the part of the journalist is the basic necessity for an effective science report.

Responsibility of Scientists

Journalists are not the only culprits who deprive the right of citizens to know more on science through various columns of a news periodical; but scientists are equally responsible. Scientists are ignorant of the impact of their inventions on society and are not ready to share their knowledge; many researchers are reluctant even to speak to the popular press, for fear of having their carefully chosen words twisted beyond recognition. Communication through conventional channel of peer-review and acceptance are their priority. Lack of understanding of people's priorities and inability to write for public, keeping them away from popular science and the ultimate tax-payer is ignored. Further, the scientists are quite unaware of the news value of their findings and its impact among the citizens. Hence they are bound to share the responsibility for the never-ending ignorance of people and lack of scientific temper. Most of the scientists prefer to remain silent in their ivory-towers leaving the taxpayers at dark. Perhaps, it may be due to their fear to communicate with the press or the anxiety about the sensationalism and speculative type of reporting adopted by many reporters which may cause embarrassment, and putting 'black marks' in his profession. In between the widening clash of interests, the worst sufferer is science journalism and the loser of the game is none other than the common man. In such a situation the noble intention of the government to propagate science among the masses will continue as an accomplished dream. And the scientific inventions and research findings would end in the cupboards of scientific institutions.

Conclusion

The most effective means of science communication to establish scientific temper is print media. In the past, it had nurtured the curiosity of mankind and there by pave way for the popularisation of science. The English language press is still continuing this rich legacy. Unfortunately the so called regional press which is having more power to transform the society is lagging behind. Science coverage in print media can be initiated only on the basis of a push originated from the ultimate readers, and that too is possible only with the help relentless efforts of scientists, journalists non-governmental organisations in the grass root level of society and good science teachers in schools. Unless readers demand for science news, journalists will not respond affirmatively. Mere science news for the popularisation of science won't help to achieve the target of creating scientific temper. A mental transformation or metamorphosis is needed to sow the seeds of scientific temper in the minds of citizens for making their life better. Science Communication and popularisation are a prologue for such thinking.

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182. Risk communication, Media Discourse, Influenza A/H1N1, Argentina

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Abstract. Mass media plays a quite important role in the social construction of reality. This is a well known affirmation. That is why to analyze mass media coverage clears up our understanding of the society which we live. The influenza A/N1H1 pandemic declared by the World Health Organization (WHO) in 2009 is both a good example of this situation and an interesting way to search in depth the social construction of reality by the media. This is also even more significant because the influenza A/N1H1 crisis combined local and global health, economic and social risks. We assume the characteristics that allow to understand this pandemic as a risk can be situated within the conceptual framework developed by sociologists like Beck (1996, 2002, 2008) Giddens (1990, 1996) and Luhmann (1996) that, with different approaches and perspectives, have explained the dynamics of risk societies. The link between the modalities of risk in modern societies and mass media coverage is also a remarkable aspect, since media discourse is deeply connected with the social perceptions of risk. The main purpose of this paper is to examine the media coverage of influenza A/N1H1 pandemic made by three Argentine newspaper of reference in the construction of the social and political agenda. The period explored goes from April 25, when the news first appeared, to July 31, 2009, when the pandemic reached the highest level of dissemination in Argentina and also coincided with the maximum level of exposition in the mass media. The study of this particular health emergency caused by the influenza A/N1H1 pandemic provide us an empirical and analytical updated about some traditional issues of media coverage of health risk communication under epistemic and social uncertainty. The methodology is based on the social discourses theory proposed by Verón (1998, 2004). Through this perspective, we study the discursive operations which define the "way of saying" of each newspaper on risk. The analysis detected specific discursive operations which delineate particular features of the conceptualization on the risk magnitude constructed and communicated by the media. "Uncertainty", a key concept in the social theories of risk, risk communication and the public understanding of science field, was also detected as an essential component within the corpus reviewed. In fact, it is relevant as a media discourse "productive condition". Taking this into account, we can say that all the newspapers examined show a high degree of ambivalence to establish the magnitude of risk. We explored how the intensity of risk, as a measure of uncertainty, is expressed into particular "discursive traces". We identified keywords and linguistic operations that refer to two semantic axes built up from different binomial to define risk. The first one refers to influenza A/H1N1 as a health threat for individual and different social levels (economic, political and social). The main binomials of this axe are "risk/safety", "threat/ safety", "unknown/known". The second one reflects the emotional; that is to say, the risk perception as a mood. The binomials included within this axe are "concern/unconcerned", "fear/fearlessness", "madness/common sense",
"pessimism/optimism". It should be noticed that each binomial have degree in valuations, and they are not excluding between them.

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Keywords: Risk communication, Media discourse, Influenza A/H1N1, Argentina

183. Reporting Science and Technology in Print and Electronic Media

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Abstract. The advancement in communication technology has made a huge growth in media industry and also has given a freedom to set new professional trends. The convergence is apparent in many different ways. Media is growing and flourishing but with this growth many questions are emerging on the credibility of its content and the journalistic norms which print and electronic media are inheriting.

A free market gives birth to the opportunities for growth and also freedom and confidence to explore new things. Media is not only a great source of information but it also gives us a platform to raise our voice. It is a fourth pillar of the democracy which has the power to ask questions. Media can set new trends by making people as well informed citizens at the same time media has the power to influence public understanding on subjects like science and technology.

To get the answers of all these questions the researcher has done a study of print and electronic media for her PhD, for which the topic was "Reporting Science and Technology Communication in print and Electronic Media" study, was a content analysis of two mainstream newspapers and Four TV channels.

It was found in the study that people are very much interested in reading and watching science and technology news/ programs but they are not satisfied with the quantity of coverage being given by TV channels and newspapers to science and technology. Foreign channels like Discovery and National Geographic Channels which shows higher percentage of science and technology programs shows more foreign countries based programs. National News channels hardly cover science and technology in news shows. The survey of the school kids, college students and professionals shows that they want a channel devoted to science and technology news and programs. They want to see what is happening at world level in the field of science and technology but they are not getting that kind of information from media. Even the content of the programs does not match with viewers/ readers choice. While the coverage of science and technology in print media improved over the years, they are not only giving more space and importance.

Keywords: Science and technology, Readers and viewers, Content, News shale, Prime time, News papers, News channels, Purpose, Treatment of the program

Introduction

The advancement in communication technology has made a huge growth in media industry and also has given a freedom to set new professional trends. The convergence is apparent in many different ways. A free market gives birth to the opportunities for growth and also freedom and confidence to explore new things. Media can set new trends by making people as well informed citizens, at the same time media has the power to influence public understanding on subjects like science and technology. To get the answers of all these questions the researcher has done a study of print and electronic media for her PhD, the topic of her study was "Reporting Science and Technology Communication in Print and Electronic Media" was a content analysis of two mainstream newspapers and four TV channels.

Method of Research: Qualitative and Quantitative

General objectives of the study

1. To identify the information needs of the audiences.
2. To evaluate the percentage of science and technology based news in print media.
3. To analyze qualitatively the extent of coverage and relative importance to various issues in print and electronic media.
4. To evaluate the percentage of science and technology based news in selected TV channels.
5. To evaluate messages of science news in print.

6. To evaluate messages of science news in television.
7. To assess the relevance of science and technology reporting to their utilization.

Specific objectives of the study

- To analyses percentage of news shoal devoted to science and technology news?
- To understand how much space is covered by foreign news and how much covered by Indian news related to science and technology?
- To understand what is the content and structural element of the news of science and technology?
- To evaluate and comparatively analyze science and technology based news on TV Channels and reasons of selecting news and programs of some specific categories of science and technology.

Time Band

Two months for newspapers and four months for four TV channels (One month for each channel)

Languages: English - Hindi

Sample Size: Two mainstream Indian Newspapers comprising Hindi and English languages and four channels of electronic media i.e. Doordarshan, National Geographic, Discovery and Aaj Tak

Data Collection

1. Questionnaire for interviews with school children, college students and professionals
2. Questionnaire for interview with science communicators and journalists
3. Log Sheet for Data collection of the News items and programs of newspapers and TV channels

Findings

Part I: What reader/ viewers think on science and technology, their knowledge on subject and coverage in newspapers and TV channels?

Results shows that readers/viewers are pretty conscious about what is being telecast on different channels and published in newspapers on science and technology, they were showed high interest in reading and watching science and technology related news and programs. Readers and viewers were not satisfied with coverage being given by newspapers and TV channels to science and technology. They wanted a separate page in newspaper and a separate channel for science and technology. At the same time they showed keen interest in programs which can provide them knowledge and entertainment. Study shows that readers/ viewers think that science and technology not only update the knowledge but also improves their quality of life and mindset. For most of respondents science and technology related information means:

1. Information on happenings in the field of science and technology at world level
2. Information on science and technology news that directly affects our day-to-day life.
3. Information on new inventions and discoveries
4. Information on new researches
5. Information on space science

On the basis of readers/viewer's choice of most relevant categories of science and technology, researcher opted only these five categories for the further analysis of newspapers and TV channels and monitored only those news and programs.

Part II: What science communicators, journalists and scientists think on Science and Technology Coverage?

- Experts view shows that people have interest in science and technology news and programs; however media is not generating awareness among people by giving more coverage.
- It reveals that information about changing patterns, new findings and discoveries, news worthiness, relevance, news which develop scientific temper among people, awareness generation should be the criteria for selecting science and technology news.
- It shows that wide coverage of science and technology can help in changing people understanding about

the subject.

- Research findings shows that scientific controversies are good but they should not be cheap and shallow.
- Experts views shows that science and technology coverage helps in fostering better understanding and practices in the society.

Part III: Analysis of Newspapers

The Times of India

- Category–The category which was covered in the news items of the Times of India newspaper in higher percentage was "what is happening in the field of science and technology around the world.
- Columns–The space given to science and technology news in the Times of India Newspaper was not sufficient. The news stories published in two columns were higher in percentage.
- Geographic Focus–The study revealed that the percentage of science and technology news was higher in percentage on the international page.
- Type of news stories–It was found that most of the science and technology news was published as the other news stories.
- Tables–The number of stories, which were published without tables, was higher in percentage.
- Statistical Formula–The number of stories, which were published without statistical formula, was higher in percentage.
- Mathematical Formula–The number of stories, which were published without mathematical formula, was higher in percentage.
- Visuals–The number of stories, which were published without proper visuals, was higher in percentage.
- Story Source–In this study researcher discovered major change in the findings, it was found that the number of news stories with Indian Source was higher than one with the foreign source.
- Tone of News–It was found that the stories with positive tone were higher in percentage.
- Purpose of news–The researcher found that in the Times o India Newspaper the maximum coverage was given to news stories which were scientifically explaining the unusual events, phenomenon, claims and reports.

The Hindu

- Category–It was found in this part of analysis of newspapers that the category which was covered in the news items of The Hindu newspaper in higher percentage was "Information on new Researches".
- Columns–The news stories which were published in four columns were higher in percentage.
- Geographic Focus–The study revealed that the percentage of science and technology news was higher in percentage in the special edition of Hindu Newspaper which published every Thursday by the name of science and technology page.
- Type of news stories–It was found that most of the science and technology news was published as the other news stories.
- Tables–The number of stories, which were published without tables, was higher in percentage.
- Statistical Formula–The number of stories, which were published without statistical formula, was higher in percentage.
- Mathematical Formula–The number of stories, which were published without mathematical formula, was higher in percentage.
- Visuals–The number of stories, which were published with proper visuals, was higher in percentage.
- Story Source–In this study researcher discovered major change, it was found that the number of news stories with Indian Source was higher than one with the foreign source.
- Tone of News–It was found that the stories of positive tone were higher in percentage.
- Purpose of news–The researcher found that in the Hindu Newspaper the maximum coverage was given to news stories which were scientifically interpreting complex phenomenon, research and development results and scientific work in laymen's language.

Analysis of TV Channels

Doordarshan

- Researcher recorded one month prime time news from 8 PM to 8.30 PM.

- In one month study, the total number of news stories telecasted were 138, while the news stories on science and technology was only 14, which means only 10.14% coverage

Aaj Tak

- The researcher recorded one month prime time news from 8PM to 8.30 PM
- Total 161 news reports were telecasted and 91 news programs of high hour duration were telecasted but no news report or program was telecasted on science and technology.

Discovery Channel

- The researcher analyzed one month programs of Discovery Channel; total 920 programs were telecasted from the channel.
- Out of which 49 programs with repeat telecast were based on science and technology.
- If we can remove the numbers of repeat telecasts only 19 programs were telecasted on science and technology.
- Out of 19 programs on science and technology only one program was based on Indian science and technology.
- Out of five categories selected for the analysis of science and technology only one category "What is happening in the field of science and technology around the world" was covered in most of the programs telecasted from Discovery Channel.
- Researcher found that out of some units decided for the measurement of the purpose of the program, the unit which was mostly covered in the programs was "Bring out the potential of scientific/technical inventions in research and development works in an area.
- It was also found that most of the programs were in documentary format.
- The study revealed that research, good scripts, excellent camera work and good narration were some of the incentives of the interest of the programs.
- The analysis of objectives and concept of the program showed quality of content, treatment and presentation of all the programs telecasted from Discovery channels was good.
- Duration of each program was one hour.

National Geographic Channel

- The researcher analyzed one month programs of NGC, total 900 programs were telecasted from the channel.
- Out of which 69 programs with repeat telecast were based on science and technology.
- If we can remove the numbers of repeat telecasts only 12 programs were telecasted on science and technology.
- Out of 12 programs on science and technology only one program was based on Indian science and technology.
- Out of five categories selected for the analysis of science and technology only one category "What is happening in the field of science and technology around the world" was covered in the programs telecasted from NGC.
- Researcher found that out of some units decided for the measurement of the purpose of the program, the unit which was mostly covered in the programs was "Bring out the potential of scientific/technical inventions in research and development works in an area.
- It was also found that most of the programs were in documentary format.
- The study revealed that research, good scripts, excellent camera work and good narration were some of the incentives of the interest of the programs.
- The analysis of objectives and concept of the program showed quality of content, treatment and presentation of all the programs telecasted from Discovery channels was good.
- Duration of each program was one hour.

Conclusion

- Readers and viewers were pretty conscious about what is being telecast on different channels on science and technology and also what is being published in the newspapers. Results of this study revealed that respondents were very much interested in reading and watching science and technology news/programmes. They wanted a separate page in newspapers and a separate channel for science and technology programmes. However, they also showed keen interest in programmes which can provide them knowledge as well as entertainment through such programs. Responses showed that science and technology news not only update the knowledge of readers/ viewers but also improves quality of life and mindset.

- At the same time, it also comes out from the study that readers/viewers are not satisfied with the quantity of coverage being given by TV channels and newspapers to science and technology news. The study examines the programmes of two of the most popular channels Discovery and National Geographic Channel which give a wide coverage to science and technology programmes. They telecast science and technology related programmes on a regular basis but the programmes are generally based on researches done in foreign countries. It was found that though the quality of production and content in all their programmes was very excellent, these two channels still do not satisfy audiences' needs as far as quantity is concerned, especially in the context of the number of programmes based on Indian science and technology.
- More focus on country specific topics by understating the information needs of people will not only help in making channel more popular but it will definitely help in generating a scientific temper among masses.
- Channels which telecast news for 24 hours. It is an ample opportunity to cover science and technology news. But as discussed the coverage of science and technology news is very less, regional and need specific issues hardly get any place in the television programmes. It was found in the study that news channels do not give much coverage to science and technology news/programmes. It was also found that there is no regular slot for the science and technology news/programmes during the primetime on Doordarshan and Aaj Tak Channel. The irregularity in science and technology news/programmes definitely affects the interest of readers and viewers. These findings also match with the hypothesis of the study.
- The content of any science and technology news/programmes plays very important role in deciding its quality. However, sometimes the content of a programme does not match with the choice of viewers/readers, which is one of the reasons behind lack of interest in science and technology news/programmes. Sometimes television channels overlook viewers'level of knowledge, choice, interests and expectations. Hence, science and technology related news/ programs should be published/aired in a simple language to increase their popularity.
- Continuity and repetition of programs, time, space, topic, quality, presentation, readers/viewers' need and usefulness of the topic also play a very important role in holding the public attention.
- For readers and viewers, proximity matters a lot. If the televised/published content is not related to their area, they lose interest in the programme/news.
- Similarly, viewers/readers have a keen interest in the news/programmes, which provide them some answers or solutions of their day-to-day problems, needs and queries.
- The study reveals that these are some of the points which have been overlooked by the newspapers and TV channels in their science and technology news/programmes. These findings also match with the points which researcher had mentioned in the hypothesis of this study.

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184. An Analysis of Message Diffusion within the Blog Community in India: Innovation–Diffusion Model Approach

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Abstract.

Purpose: Viewing the blog technology as an integral part of the current social-technical environment, this research aims to investigate whether the main influences on message diffusion within a blog community originate from external mass media channels or internal interpersonal communication channels.

Research Methodology: This study addressed two research questions: RQ1. Which channel, interpersonal or mass media, provides the main influence on the message diffusion in a blog community?

RQ2. How does the external mass media influence the message diffusion in a blog community? Specifically, I aimed to understand whether the interpersonal communication power in blog community would be influenced by the presence of a large number of news items related to the same topics being reported in the mass media. Furthermore, because the typical diffusion curve had an S shape, the diffusion patterns might differ between before and after the inflection point. I treated the week with the most news reports appeared in the mass media as an inflection point, which was used to divide the entire diffusion period into two distinct data sets. I then analyzed the patterns and explanatory power for changes between before and after the infection point. This methodology allowed us to determine whether the number of articles in a blog community increased due to the large quantities of related news items reported by the mass media.

Findings: The results indicate that the mass media is the main source of message diffusion and that the internal communication power may increase as the opinion leader promotes these messages.

Research limitations/implications: Other factors that may influence message diffusion such as topic, design characteristics, and the existing social network have not been included.

Practical implications: For practice, the result indicates that the mass media and the blog might complement each other.

Keywords: World Wide Web, Communication, Mass media, Social networks

185. Building Networks Better Science Journalism in Africa

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Abstract. The Issue: Science has not been a very popular subject in the mass media but it is still regarded as important by the mass media in much of the advanced world. In Africa, and sadly so, it hardly has a place. While majority of the media rarely reports science local or global, most of those who do only cut and paste third party news and features from foreign papers and websites. Original reporting is glaringly missing. Local scientists suffer while the gap created is easily filled by sensational stories of pseudo-scientific claims and other hoaxes. True as it is that science journalists alone cannot account for robust science communication, the mass media is a critical success factor. That is why it is extremely important to build the missing capacities and networks that are necessary in mainstreaming science in the mass media. I will be interested in sharing my experiences which span mentoring, training and network building in aid of science journalism across Africa hoping to gain new perspectives and relationships.

Keywords: Africa; Science Journalism; Networking

186. Using Social Media to Spread Science and to Engage Readers in Conversation

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Abstract. In this paper, we examine "the top 20 Most Popular Science Websites" as established by eBizMBA (eBusiness Knowledgebase) in July 2010, based on three major traffic ranking websites. These top 20 websites includes magazines, blogs aggregators, a press release aggregator, research institutes, academic journals and so on. We aim to understand how popular science websites use the Web and its social features to communicate science and to engage the readers in conversation. We analyze these top 20 sites by focusing on how they display their information and use social media to interact with their readers. Moreover, we complete this study by analysing their behaviors on Twitter. Finally, we discuss our findings and how science websites spread information and stay connected with their readers.

Keywords: Media, Science news, Scientific communication, Social web, Twitter

Introduction

The Web 2.0 is interactive, real-time, and let everyone contribute. It eases the dissemination of information by allowing anyone to publish, share and comment content on the Web [9]. It thus provides a large amount of free-access information available online. However, this raises some issues on how to retrieve the relevant content and to give credibility and trustworthiness to a science website.

The Pew Internet Survey [4], conducted in USA, have found that 20% (40 millions) adults use the Web to get science news and information, while television remains the first source with 41% (newspapers and magazines get a score of 14%). However if they need to search for specific scientific information, then the Web is users' first source according to this survey: "The Internet is a research tool for 87% of online users (128 million adults)". However, more than a research tool, Web 2.0 allows also users to react to what they read. [3] wisely encourages users to be more active on the Web and to interact with journalists, experts and so on. He aims "to help people become active and informed users of media, as consumers and as creators". Indeed, we believe that letting readers to ask questions, to discuss with authors, experts, journalists, etc. are an important element of a democracy. Therefore, we were then interested in understanding how the most popular science websites use Web 2.0 features to provide their readers with opportunities to comment and share information.

In the next section, we review some of the current challenges for science writers and science websites. In Section 3, we present our methodology and describe the analysis of the top 20 science sites in Section 4. Subsequently, we examine how these websites use Twitter in Section 5. Finally, we conclude our paper in Section 6.

Motivation

A challenge for science writers

Being a science writer on the Web requires new skills in addition to the ability of writing well and communicate science facts. This include having multimedia competences [2] and being able to up to date information in real-time (as opposed to printed news that cannot be edited once they are published). Science writers now need to interact with their readership and adapt their process accordingly, while they were used to produce information and then let the audience passively consume it.

Web 2.0 not only challenges the profession; it also provides opportunities. For instance, the formatting of articles on the Web generally provides more space for science news, whilst this is a constraint in printed version [13]. However, since anybody can publish science news on Internet, science writers' profession is then truly affected and needs to redefine its mission and habits, if writers do not want to be bypassed [14] and still want to make a difference compared to others writers.

Indeed, scientific content produced by scientists themselves can be freely accessible [13] for any interested users. Moreover, as surveyed by [7], researchers try to directly address themselves to a broader audience in order to share their knowledge and expertise.

Furthermore the top 20 (see Table 1) shows the interest by the audience to such content, since it includes academics sites such as sciencedirect.com, an academic database. It also contains sites written by researchers for a broader audience such as scienceblogs.com. This is in our opinion an interesting aspect, as this kind of science website was not included in the classification provided by [13], which shows a fast and growing evolution of the online science news ecosystem. Indeed, as described in Section 3, this top 20 includes different types of sites, emphasising the variety of content and creators that one may find on the Web.

Credibility of online scientific content

We believe that the Web helps the dissemination of scientific messages. However it raises also many concerns about the difficulty for users to establish the value, credibility, reliability and trustworthiness of scientific information they browse [8] [12]. Indeed, this information available online can be created by anybody, making more difficult to differentiation between a site and another.

[11] studied the factors that influenced people about the credibility they give to a science website. They distinguished users with low involvement in science from users with high involvement. The three criteria used to judge the credibility of a science website are the domain, the popularity and the attractiveness. They found out that a website using the .gov extension (reserved to governmental sites) is perceived as more credible than a .com extension (that everyone can buy). Another study [8] concludes that information professionals - such as librarians - are key players to help users to retrieve valuable information and then enhance perception and awareness in science. The Pew Internet Survey [4] reveals also that 54% of online science consumers go to the original source of the information retrieved to check the reliability of the news. According to [11], the characteristic related to the completeness of the information and its verifiability is important for an audience highly involved in science.

Methodology

We analyzed the top 20 most popular science websites established by eBizMBA (eBusiness Knowledgebase) in July 2010 (See Table 1). Their ranking is based on the average of the three following traffic rank websites : Alexa, Compete and Quantcast. In order to figure out how sites display their content and use social media to interact with users, we manually read and analysed between 10 and 15 random news items from each science website, leading to a total of 253 news analysed . We selected articles from different categories such as “top stories”, “technology feature”,
“favorites”, “editor’s choice”, etc. We also studied the website’s blog, if any. We followed a similar process for each sites. We mainly observed (1) the general information displayed (author, date, contact), and (2) the social aspect it provides, such as comments, integration with Web 2.0 sites like Facebook and Twitter (we will describe these sides in section 4.2), etc.

Finally, we observed the Twitter account of these science websites (see Section 5). By studying the conversational patterns (such as replies) of these websites on Twitter we could establish why and for which purposes they use it, i.e. to interact with others or simply to spread information.

Table 1. Top 20 Most Popular Science Websites, July 2010.

	Science website	Unique visitors/month
1	howstuffworks.com	12,000,000
2	noaa.gov	10,000,000
3	discovery.com	9,400,000
4	nasa.gov	8,900,000
5	sciencedirect.com	4,500,000
6	sciencedaily.com	2,400,000
7	nature.com	1,800,000
8	treehugger.com	1,700,000
9	popsci.com	1,400,000
10	scienceblogs.com	1,250,000
11	physorg.com	1,200,000

12	newscientist.com	1,000,000
13	livescience.com	950,000
14	space.com	750,000
15	scientificamerican.com	700,000
16	redorbit.com	600,000
17	sciencemag.org	550,000
18	eurekalert.org	400,000
19	hubblesite.org	350,000
20	sciencenews.org	250,000

Dataset Discription

We identified two main characteristics in our dataset (see Table 1). The first aspect is the website's origin, i.e. whether it was directly a Website, or was created from a genuine media, such as a scientific newspaper or magazine. Five websites are the online version of a printed edition: popsci.com, newscientist.com, scientificamerican.com, sciencenews.org and nature.com. Nasa.gov, noaa.gov and hubblesite.org are websites of research institutes to communicate about research and outreach science and technology accordingly. Finally, discovery.com was first a TV channel. Interestingly we noticed the inverse phenomena for howstuffworks, the number one in our top 20 science websites (see Table. 1), which could get a TV version . The 11 other sites are educational website (howstuffworks. com), science blogs (treehugger.com, scienceblogs.com), science news (livescience.com, space.com, redorbit.com, sciencedaily.com, physorg), academic database (sciencedirect.com), academic journal (sciencemag.org) and press release aggregator (eurekalert.org).

The second aspect we identified is websites aiming to display sources such as academic papers or press releases. For instance, sciencedirect.com is a scientific database, nature.com is a scientific academic journal and eurekalert.org is a press release aggregator. Nasa.org and hubblesite.org also provide press release. Such a science websites included in the top 20 show a will from the audience to have access directly to sources usually used by science writers to report on findings.

Thus, the list of the top 20 science websites ranged from websites providing access to academic papers, to sites delivering press release, through news and stories outreaching findings and more generally science and technology.

Authorship

For a news item, displaying the name of an author in addition to his title and/or a brief biography might help the readers to give credibility, reliability and trustworthiness to the website. We thus checked that first characteristic and also looked at whether authors provide email address to be contacted by their readers.

80% of science news items that we studied were signed by authors, while 15% could not be specifically identified. For instance, some articles from space.com are signed "TechNewDaily Contributor" or "space.com staff". Physorg.com does not systematically sign their news, but the copyright is given at the end of the article such as
"©2010AFP". 5% articles from our whole dataset are not signed at all. Moreover, 62% of the articles observed do not provide author's title or author's biography. For sites such as nasa.gov and hubblesite.org, this information might not be essential to give credibility to the news since the website itself is identified as credible according to [11]. In contrast, scienceblogs.com displays an author's biography on the left column of the website. Another criteria we looked at was the creation date of the article, helping to put a story into context. 98% of our dataset provides this information. Furthermore, we explored whether or not an email address was given. We made the difference between the ability to contact the site and the capacity at emailing an author specifically. In the latter case, only 22% of science news studied displayed such information. This information was given especially by sciencedirect.com, eurekalert.org, nasa.gov and scienceblogs.com. These websites, as described earlier, display either press release or publications; which imply to give contact information. News items posted on scienceblogs.com are mainly written by scientists, for whom such information may be a mean to discuss their research interest and increase their network.

Overall, we did not identified specific patterns that would allow us to make a difference between sites. Most of them display the authors' name with a tendency to not add his title / biography and a contact.

Analysing how they engage users in conversation

We then observed how readers can be engaged in conversation, by studying the comment section of news items and their integration with social media services such as Facebook and Twitter.

About 30% of sites do not provide a comment section. They are mainly represented by nasa.gov, sciencedirect.com and eurekalert.org, which provide press release or academic publication. Therefore, as seen earlier, these sites do provide email but do not allow comments. Regarding the news allowing public comments, very few of them got reply by the article's author. We noticed that only scienceblogs.com made a visual distinction between author's comments and users' ones, which allows readers to solely follow author's comments if wished. Furthermore, we observed that the comments' number tend to be lower than the number of posts on Twitter, Facebook recommendations or bookmarks using Digg, when this data is available such as in Figure 1. Here, a news from sciencemag.org had only 3 public comments but 570 recommendations via Facebook and 136 links from Twitter. This may reveal a will by readers to engage conversation with their community using their Twitter or Facebook accounts.

Twitter, Facebook, personal email, Delicious and Digg are the five most popular way of sharing an article in our dataset. Delicious and Digg are two social services allowing to bookmark pages. Facebook is a social network service with more than 500 million active users and "more than 150 million people engage with Facebook on external websites every month" . Finally Twitter is a free social media service launched in 2006. In September 14, 2010, it had 160 million registered users with 90M tweets written per day . It allows users to spread update to their followers up to 140 characters. Anybody can follow users of their choice, which do not imply reciprocity.

Therefore, personal email implies predefined recipients while Facebook and Twitter are addressed to a larger community. However, Twitter is the only one with an open audience, which allows to achieve a wider diffusion and also offers the ability to engage authors or science websites with their readers, without the need to know or follow each other.

We also analysed whether these websites are present on such services or not. 11 have a Facebook account, 17 a Twitter account including 7 with a Twitter account but no Facebook one, while 3 do not have accounts on these services (sciencedirect.com, nature.com and sciencenews.org). However, in this paper, we will not discuss the strategy and motivation behind those websites to get an account or not.

The following section presents a analysis of how Twitter is used by these websites. Indeed, we believe Twitter has this potential to enhance conversation between experts, science writers and broader audience [7]. Moreover other surveys showed that 19% of Web users use status-update services, such as Twitter, to share and see updates online [5].

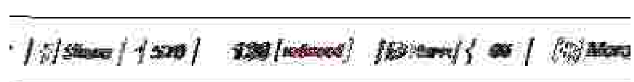

Figure 1. Comments versus Social Media (From http://tinyurl.com/298t46b, taken on 30 October)

Twitter analysis

To establish our dataset, we distinguished official accounts from other accounts using same usernames (but created by fans for instance). Therefore, we searched on websites' homepages whether or not they have a link to a Twitter account. By doing so, we could trust the provenance of a Twitter account. However, when no link was provided, we manually search on Twitter for such an account, looking if it was certified or not (see Figure 2.) We then analysed the Twitter feed of 16 websites (Table 2). This dataset does not include nature.com and sciencenews.com since they do not have a Twitter account, nor hubblesite.gov and space.com due to technical errors in our crawling methodology (described next). Moreover, while @usnoaagov, @sciencedirect, @sciencedaily, @scienceblogs and @ redorbit are not certified account, we kept them in our dataset.

During 4 consecutive days, we crawled (1) the Twitter feed of these 16 Twitter accounts, leading to a total of 1560 tweets (i.e. Twitter messages) and (2) all tweets containing a reply to any of these usernames (following the @username pattern) (Table 2), leading to a total of 6932 replies. We then noticed a high tendency from users to engage with these science websites on Twitter. The following section describes in further details the results. In addition we manually noted the number of followers and followings of each Twitter account. Followers being users who follow the update of the Twitter account @user_A. Followings being users followed by @user_A. Then by following the classification suggested by [6], we established 15 of them are likely to belong to the media category (which is actually the case) since their number of followers is much more superior to the number of followings, while redorbit.com got a higher score of following versus followers.

Figure 2. Certification Twitter Account

Analyse of our twitter datasets

To analyse the tweets displayed by science websites and replies addressed to them, we studied the following conversational patterns containing into the original tweets: replies (@username) and hashtags. This latter is a commun practice that consists in using keywords in messages, marked as #tags. We also studied the retweets to see if they are a way to engage conversation [1]. “Structurally, retweeting is the Twitter-equivalent of email forwarding where users post messages originally posted by others” [1]. In addition, we also looked at the proportion of hyperlinks.

As shown in Table 2, most of the accounts largely include links into their tweets revealing a will to use Twitter to widely spread their news. While 7 accounts seem to use Twitter solely in that purpose, the others tend to add conversational patterns into their tweets, such as @discovery and @sciencedirect that get a high reply score. Also @discovery and @eurekalalertaaas tend to add tags into their tweets, which may help them to be reached by users outside their community who follow the tags. Finally @sciencemagazine, @treehugger and @discovery seem to retweet often.

Table 3 shows the conversational patterns used in replies addressed to these accounts. It shows a global tendency to get tweets addressed to science websites accounts, especially @nasa, @treegugger and @newscientist who get respectively 1478, 1033 and 781 distinct users interacting with them. Interestingly as described in Table 2, they are also part of the accounts that use conversational patterns. Therefore they are likely to use Twitter to engage users in conversation. We also have accounts such as @sciencedirect that only get 2 replies with zero retweet, while 85% of their orginal tweets contain a reply pattern. Yet, @popsci use Twitter to only spread links, but get a high score of retweet from 227 distinct users.

In conclusion, Twitter is mainly used by science websites to spread news via hyperlinks

Table 2. Analysis of the Conversational Patterns in their tweets

	#tag (%)	@user (%)	Link (%)	RT (%)
@howstuffworks	0	25	86	16
@usnoaagov	12.5	0	92	0
@discovery	42	70	62	23
@nasa	3.5	27.5	79	2
@sciencedaily	0	0	100	0
@sciencedirect	0	85	15	0
@treehugger	11	22	96	24
@popsci	0	0	100	0
@scienceblogs	0	0	91	0
@physorg_com	0	0	100	0
@newsientist	20.5	10	90.5	4
@livescience	0	0	61.5	0
@sciam	2	5	95	13
@redorbit	0	0		

100	0.5			
@sciencemagazine 25.5		11.5	3	94.5
@eurekalertAAAS 16.5		25	72	100

and to try to reach more users. These tweets are then well retweeted by users as shown in Table 3. Hashtags and replies are used by some science websites Twitter accounts. In the future, we will go further in the analysis to figure out the quality of the conversation and the profle of the users.

Conclusion

In this study of the top 20 science websites, we outlined the current tendency by users to visit websites not only written by science writers, but also sites that distribute sources such as academic papers and press release. Moreover, the presence in the top 20 of sciencebogs.com shows also the popularity of news written directly by researchers to a broader audience. Furthermore, readers seem to prefer engaging conversation using social media services where they have an account, rather than directly on the website. We also observed that the Twitter accounts of science websites are mainly used as a mean to reach more readers than to engage with users.

Finally, based on our result we believe that Twitter might be a relevant service to engage readers in conversations on scientific and technologic topics.

Table 3. Analysis of the patterns in messages addressed to science websites

	#tag (%)	Link (%)	RT (%)	Users (number)
@howstuffworks	42	42	53	158
@usnoaagov	46	63	63	102
@discovery	24	29	49	487
@nasa	16	55	38	1478
@sciencedaily	19	86	60	119
@sciencedirect	0	0	0	2
@treehugger	24	81	46	1033
@popsci	34	77	66	227
@scienceblogs	6	96	24	190
@physorg_com	14	63	69	294
@newsientist	30	56	70	781
@livescience	21	95	73	49
@sciam	19	67	65	437
@redorbit	8	67	40	19
@sciencemagazine	35	70	63	87
@eurekalertAAAS	20	70	81	19

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187. Science Communication in West Bengal: Role of Mass Media

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The first Bengali essay on science was being published in 1818 in the magazine called Digdarshan with an initiative of the Christian missionaries of Sreerampur. Kolkata Book society also took major initiatives to publish science related journal in the year 1812.But science communication should not be confined within the framework of magazines. It can be asserted that science communication became possible from the day on which people of Bengal could feel the essence of science and Bengali simultaneously. But the main thrust of our paper is the progression of science communication in Bengal during post-independence era.

Before entering into the arena of science communication, let us discuss a little bit about communication. Communication is the process of sending and receiving information. It is the vehicle through which we develop, maintain and improve human relationships. Communication word is drawn from communis (Latin derivation), which means common; the idea of commonality is frequently stressed in dealing about communication. According to National Communication Systems, UNESCO, Communication is part of the very fabric of society. It takes place at all levels between peoples and between institutions, from government to people, from people backs to government and through many channels both inter-personal and mediated. Communication expert Berlo said, "Communication does not consist of the transmission of meaning. Meanings are not transmitted or transferable. Only messages are transmitted and meanings are not in the message, they are in the message users." Even in MacBride Commission's report (1978), namely 'Many Voices, one World' explain the communication process as the motor and expression of social activity and civilization. According to this report, Communication maintains and animates life; it leads people and peoples from instinct to inspiration,, through variegated processes and systems of enquiry, command and control; it creates a common pool of ideas, strengthens the feeling of togetherness through exchange of messages and translates thought into action, reflecting every emotion and need from the humblest tasks of human survival to supreme manifestations of creativity-or destruction. Communication integrates knowledge, organization and power and runs as a thread linking the earliest memory of man to his noblest aspirations through constant striving for a better life.

Human civilization has been possible due to evolution and revolution in communication process. Science and technology could never be possible without underlying developments in communication. Communication can be formal or informal. Communication of science is a specialization in itself. Science communication is a discipline that has developed rapidly in theory and in practice since 1995 in the whole world. Though science communication initiated in India in early 19th century, but it was remarkably developed in mid of 20th century. In Australia, in 1996, the formation of the Centre for the Public Awareness of Science (CPAS) at the Australian National University (ANU) heralded the start in the science communication movement. The new approach aimed to involve the public more in the processes and culture of science, to create an awareness of what science was attempting to achieve, to cultivate the
'need to know' that is the hallmark of good communication.

It has become an important issue of public policy since 1990. It is, however, one of respectable antiquity, dating at least from the origins of the Royal Society in the seventeenth century. For examples of eighteenth and nineteenth century science communication. Indeed, it has been argued that the purpose of the Royal Society was one of communication, to assist in the application of the 'New Philosophy' to the defence of the Realm, most particularly by way of the Royal Navy.

It is commonly accepted that there are five general categories under which arguments can be made for the importance of the communication of science. They are (i) the economic argument (the contribution science can make to the national economy and individual wealth), (ii) the utilitarian argument (people owe much of their health and well-being to scientific invention), (iii) the democratic argument (to be fully informed enfranchises people), (iv) The cultural argument (the best science is, in company with the best of other areas endeavour, high art) and (v) the social argument (at every evolutionary stage – stone, bronze, iron, industrial, biological – science underpins the evolution of society).

Communication in science can be at different levels and of different kinds:

- Primary Communication where a scientist communicates to peers, colleagues and fellow scientists. This communication can be seminar presentation, short rapid communication like 'Letter to Nature', research papers and review articles.
- Communicating to students and learners, which include classroom lectures, demonstrations, writing of textbooks and so on.
- Journalists' reporting and news items communicated through press conferences and mass media both in print (newspapers, magazines, periodicals etc) and electronic form, they include science newsletters, news digests newspapers and channels, and in such publications as New Scientist, BBC Science News Channel, and PTI Science etc. Amalgamations of traditional media and modern mass media originate a new kind of communication process especially in third world countries. Interactive media like Internet plays a pivotal role in today's science communication.
- Popular level communications are those, which meant usually for general public. In such communication, communicators may be scientists, writing on their own specializing field as also on other fields. J.B.S. Haldane, Gopal Chandra Bhattacharyya, Abdullah al Muti Sarafuddin etc. are examples who wrote profusely on subjects both of their specialties and beyond their specialties.
- Communication to children and juveniles – is a special breed of science communication and is probably most difficult one. Illustrations are the most supporting factor in such communication.
- Another very important communication modes for science are documentaries and science shows.

Dr. Manoj Patairiya in the portal of UNESCO said that -"one of the reasons for the science reporting to have remained underdeveloped in our country may be due to the fact that except for a few dry and drab articles, technical information or news, and hardly any other modes of science writing were employed. May be this is why common man could not come to terms with science and technology. If science is presented in the form of stories, poems etc. common man not only would be able to read, but also would understand and appreciate science

But country like India is though progressing in fascinating way in the field of science and technology, but far lagging behind in communicating science to the common people. In the arena of space programme, atomic energy production and consumption, oceanography, biotechnology, information technology, electronics, - India is progressing rapidly. Indian society has reached a complex socio-economic and cultural stage. It differs from the western world in which Philip Cambell is experiencing a glut in science communication. The literacy rate in our country is very low, the science literacy is much limited and only a thin section of society is aware of frontiers in science, e.g. the information technology and biotechnology. The public and the leaders in various sectors whether illiterate, literate, educated, professionals or executives live with philosophical conflict of religion and science and cultural conflict of tradition and modernity.

An increase in coverage of science in our media seems to follow the world trend, which is predominantly occupied with the abstracts of the stories of neurobiology, biomedicine, astronomy, and information technology, etc. Cambell agrees that the media stories speak very little about the public understanding of science but he believes that it will automatically grow over the years due to the public interest for science. This view looks oversimplified in the Indian context, which possesses a very heterogeneous public significantly differing in socio-economic, cultural and philosophical levels.

Science communication has been a major concern in the country for several groups of people over the years. Certain government, non-government and voluntary agencies have been experimenting with programmes predominately with the involvement of school children. They have developed many new ways of science communication, e.g. performing and folk arts forms, joy of learning with plays and toys, discussion forums, science clubs, seminars, explaining and exploring miracles and mysteries, children science congress, nature watch and excursions, slide shows, planetarium, exhibitions, science parks, etc.

More seriously planned agenda and policies for science communication in a truly transparent manner are a pre-requisite to organize and speed-up science communication in India for the new millennium and to develop a public consciousness of the issues and the understanding of science in a more strategic manner. We have to be more methodological and institutionalized on one hand, to consolidate, and to go beyond all the institutional and framework boundaries with several innovative ideas to expand, on the other.

In India, historically, the importance and application of modern science and education emerged during the 19th and the first part of 20th century chiefly under the colonial guidance of British rule. The term "popular science" was unfamiliar at that time only because people in general had nothing to do with 'science'. So far as Bengal is concerned we find only a handful of eminent scientists and writers to be actually inclined to express the content and concept of science in popular form in Bengali language. As a result, Akshay Kumar Dutta, Ramendrasundar Tribedi, Prafulla Chandra Roy, Jagdish Chandra Bose, Jagadananda Roy, Satyendra Nath Bose were in limelight for popular science writing in Bengali. They applied common sense and gave example from every day life to make their science writing more simple, gentle and lively to common mass. I have already said that in the period though some science lovers took their pen to ventilate their scientific thoughts in vernacular language, but the concept of popularization of science among common mass remained absent. After the Independence of India, Prof. Satyen Bose took initiatives to cater scientific thoughts in the mind of general people or getting in people involved in 'popular science activities' in a big way. If we look back in the past then we see in 1948 he founded Bangiya Bigyan Parishad with a mission to encourage regular culture of science in the language of the soil. Actually people's science movements sprang up in different parts of the world during the 19th and 20th century: Eureka in Germany, science clubs in the Baku region of the Czarist Russia etc were some of them. The tidal force of science movement also sprinkled on the seashore of India. The Bangiya Bigyan Parishad in Bengal, the Assam Science Society in Assam, the Bigyan Prachar Sabha in Orissa,initiated by JBS Haldane, Sastra Sahitya Samithy of Kerala etc were some of the early ones. The Kerala Sastra Sahitya Parishad was properly formed in August 1962 with the limited objectives of functioning as a platform for science writers in Malayalam: "A Science Writers Forum". But credit goes to the Kerala Sastra Sahitya parishad for coining the very term 'PSM'- People's Science Movement' in the year 1978 for giving a name to a forth coming workshop involving 'like minded' organizations. During the 50s and the 60s, a movement gradually developed with the initiative of a section of educated class in West Bengal and Kerala, through encouragement in practice of reading and writing science, beyond academic periphery and also through model making, poster displaying, rendering health services to the community, through arranging lectures and debates on various science topics in a more or less amateurish way. Small science clubs were formed at both the urban and suburb areas. Thus a science club movement became quite popular in Bengal at that time. But the basic alienation of science from common people was still prevailing. Because only collecting and presenting information of technological achievements, highlighting fascinating functions of applied sciences and focusing on God-like magical efficacy of high-tech devices could not produce much impact on the consciousness of the mass as a whole. People in general did not get involved spontaneously in science or scientific activity. Not only so, after independence, one major problem that the state of West Bengal had to face was the problem of the rehabilitation of the refugees, who came from East Pakistan (presently Bangladesh). Naturally the priority of the state government was to resolve that problem. So the rehabilitation problem made science movement orphan in West Bengal just after independence. Thus the science movements in West Bengal did not get governmental patronage just after the independence.

Actually in 70s, people of India awakened from dormant condition. The scenario was now changing slowly; popular science now took a new look towards the people science movement. In West Bengal, this change or development was likely to have been related to revolutionary turmoil in radical political activities shaking the social, cultural and ideological frame of the society. We observed that all over India, people science movement simultaneously charged up due to the participation of the people of the different segments of the society. Novelists, artists, literature lovers, - the people belonging other than the world of science activated in several other Indian states and steered by non-political organizations like Kerala Shastra Shahitya Parishad in Kerala, Lokavigyan Sangathan in Maharashtra, Kishore Bharati in Madhya Pradesh. Automatically the science movement got kinetic energy to spread among the different segments of the society. The basic ideas of people science were propagated through some powerful slogans as: Science for the people, of the people, by the people, Science for social changes, science for better living, and science for emancipation. A new wave of movement bonded with science as the instrument, having deep social and political orientation, moving the common people emerged in West Bengal since the 70s.

Linguist Sri Sukumar Sen was curious to know about the use of the word 'Bigyan' in Bengali in the modern sense. Till 1860s the word 'Bigyan' has been used in Bengal in its etymological sense. Both 'Vidya' and 'Bigyan' have been used synonymously in different journals and magazines in Bengal till 60s of 19th century. The first Bengali book on science was published in May of 1817 when BankimChandra published 'Bigyan Rahashya' (the mystery of science). According to eminent scientist Gopal Chandra Bhattyacharya, children learn easily and aptly from practical experiences. Scientific communication enhances the curiosity regarding different things among students in a better way. Most of the developed countries utilize science communication as a mode of education that is almost absent in Indian scenario. Eminent Biologist Prof. J,B.M Halden asserts that science in its true sense is not applied for the development of Indian society.

During the post independence period in Bengal, students have not opted the science subjects out of love and interest rather as an instrument for academic score. Science education in schools, colleges and universities is limited within the pages of books rather than practical implementation. In 1985, held a workshop on Science Education in Bangalore where resolutions were initiated by UNESCO. Observation, inter-active session, project making, research, planning, field-work, measurement, using charts, experimental proof, information and communication were different processes mentioned by UNESCO of educating the students from primary level.

In 1957 and 58 in West Bengal, Radhika Baghchi, the science teacher of Scottish Church School engaged the students in practical works of science which was later named as Laboratory. Another science exhibition was organized in the premises of Scottish Church School in 1962. The headmaster of this school set up the institution named Science for Children in 1963.In 1967 amateur astronomers' association was established by St. Xaviers College. Birla museum (1959) had a major role in spreading scientific education beside traditional education.

In mid 60s Indian Radical Humanist Association set up by Manabendra Nath Roy also adopted an important role in popularizing science in Bengal. Several science clubs and institutions motivated the common mass to be more scientific even in their regular chores of life. Among these Howrah Bigyan Parishad (1968), Jadavpur Science Association (1971),Gobordanga Renaissance Institute (1973),Ashoknagar Bigyan Sangostha(1974), Chandannagar Science Club (1971), Paschimbanga Bigyan Karmi Sangostha (1975), The Science Association of Bengal (1977) are noteworthy.

Many people say that, the growths of Science & Technology after independence have increased the growth of Scientific Periodicals. It could not be said that after the independence in 1947 that type of progressive scientific age had come. It was true that the publication of the Jnan O Bijnan was started from 1948. But that was an exception. There was no other prominent science magazine before the sixties or seventies. In 1961, a tri-monthly magazine was published namely, Manabman (Human mind). It was a magazine of psychology, biology and social science. The main aim of this magazine was to develop the idea of a movement for a healthy mind both of the individual and the society. This magazine is continuing even today.

We have pointed out that the last part of 1960s and the whole of 1970s were the period of establishing different science clubs in West Bengal. Many people of the city and urban moffasils attracted to the science club movement. The aim of these science clubs was to make the young generation scientific in their attitude to life. To reach this goal, the science clubs organized some activities like model-making, sky-watching, science exhibition, science quiz, discussion, etc. To spread these ideas, these clubs published periodicals and pamphlets on science. So afterwards, these types of science clubs & different types of voluntary organisation published major science magazines. Now we will discuss about those magazine. The importance of mass media can never be ignored in Science communication. Both print media (Newspaper, Periodicals, Magazines etc.) and audio-visual media like Radio, Television, Internet etc. have major roles to play. The first science magazine after independence of India was 'Gyan O Bigyan' which was published by Bangiyo Bigyan Parishad in 1948. Later 'Manab Monn'(1961), published by Pavlov Institute, 'Swasthya Dipika'(1963), 'Prism'(1979), 'Lok-Bigyan'(1974) were the important science related magazine. In 70s 'Bikhyan' and 'Bigyan O Bigyan Karmi' were published parallelly with 'Manus', which had individual characteristics in science publications. During early and late 80s of 20th century several science magazines were published.

1948

Jnan O Bijnan: A monthly periodical on science, published in January , 1948 under the auspices of 'Bagnio Bijnan Parishad' , Kolkata and the editorship of Prafulla Chandra Mitra. This Periodical has been playing a major role in popularizing science among Bengali knowing people. It is still continuing its publication.

1953

Homsikha: A monthly periodical on agriculture, published from Krishnanagar, Nadia under the editorship of Kaliprasad Basu.

1959

Rogi-Chikitsa: A Bi-monthly periodical on homeopathy, published under the aegis of Sundar Homeo Sadan, Kolkata.

1960

Ayurved Bijnan Patrika: A monthly periodical on Ayurveda, was published from Kolkata under the editorship of Kabiraj Krishna Kanti Roy . Apart from articles on ayurveda, few artices on general medicine and mathematics have also been covered.

1961

Ayurved -Bharati: A multi lingual (Eng-Beng-Hindi-Sanskrit) quarterly journal of ayurveda and Indian culture, published as an organ of the ayurveda Bijnan Parishad, Kolkata under the editorship of Bagala Kumar Majumder.

Manabman: A quarterly periodical, describe in Bengali as 'Manavjivan, Jivijnan o Samajvijnaner Adhunik Dhara Parichayak Trimasik Patrika, published under the aegis of 'Pavlopv Medical Research Centre' , Kolkata and the editorship of Dr. Dhirendranath Ganguly (Founder Editor).The periodical still continuing its publication.

1963

Swasthya Dipika: A monthly periodical on health, published from Kolkata. The contributors in its periodical are mostly doctors by their professon. The periodical is still continuing its publication.

1964

Sar Samachar: A quarterly periodical on agriculture, published under aegis of The Fertilizer Association of India', Eastern Region, Kolkta and the editorship of Sashanka Banerjee. The periodical is still continuing its publication.

1965

Anka Bhavna: A quarterly periodical on mathematics, described in Bengali as 'Anka Bisayok Trimasik Patrika', published from the Kolkata, under the editorship of Kunal Kumar Majumder and Anandamohan Ghosh.

1966

Bijnan Barta: A monthly periodical on Science, published from Kolkata under the editorship of Anjali Chowdhury.

1968

Two periodicals, which are described, bellow have been established in this year:

Nabanna Barta: A monthly periodical on farming, published from Kolkata under the editorship of Jyotirmoy Ghosh.

Sahitya O Vijnan: A quarterly review of literary and scientific writings, published under the auspices of 'Sahitya Ovijhan Parished' Sodepur, 24 pgs (N) and the editorship of Ramprasad Sarkar and Rajkumar Mukhopadhyay.

1971

In all, three periodicals, which are described bellow, took birth in this year:-

Esana: A quarterly periodical on Science, published under the auspices of Asansol 'Vijnan Parishad', Burduan and the editorship of Biswajit Mukherjee.

Sarir Barta: This quarterly periodical devoted to Physiology and allied subjects was published from Kolkata under the aegis of 'The Physiological Society of India'. The editorial work of this periodical was done by Debajyoti Das and Umasankar Sarkar.

Bijnan Bichitra: An organ of Murshidabad zilla Vijnan Parishad, Murshidabad, published under the editorship of Himangshu Sekhar Ghatak. The periodical used to have articles on popular Science.

1972

The year witnessed the birth of four periodical, which are described, bellow:

Banabani: A quarterly periodical on forest conservation and related fields. Published from Jalpaiguri under the editorship of Rukmini Mohan Bhattacharya

Chas-Bas: A monthly periodical on agriculture, published from Kolkata under the editorship of S. Biswas. The periodical is still continuing its publication.

Dhnadha : A monthly periodical on Scientific Quiz especially on mathematics, published from Kolkata under the editorship of Biswanath Basu.

Gobordanga: A monthly periodical described in Bengali as 'Sambad Sahitya o Bijner Masik Patrika', 24pgs(n) under the editorship of Mani Dasgupta.

1973

Chikitsa Barta : A fortnightly periodical on medicine, published from Kolkata.

1975

Five periodicals, which are described, bellow have been recognized in this year: -

Ganit Parikrama:A semi annual publication on mathematics , published under the aegis of 'Association for improvement of mathematics teaching, Kolkata and the editorship of A.mukherjee.

Homeo Keton: A monthly periodical, published under the auspicious of Homeopathic Medical Association of India, W.B, state branch , Kolkata and the editorship of Prabhat Kumar Bhattacharya. The periodical was renamed later as 'Homio Jyoti'.

Lokvijnan: The monthly periodical devoted to popular science, published under the auspices of 'Howrah Vijnan Parishad' and the editorship of Dr. Sushil Kumar Mukherjee.

Prakriti: A popular illustrated monthly compilation of article on natural history, nature study, life & environmental Science, published in Nov, 1975 from Kolkata under the editorship of Ajoy Home. Probably the periodical changed its title in 1980.

Vijnan Parikrama: The periodical devoted to science, published under the auspices of Konnagar Science Club. It was a half-yearly publication and was published from Konnagar, Hooghly, under the editorship of Nitai Chandra Porel.

1976

Jnan Bichitra: The monthly periodical devoted to popular science, published by 'Jnan Bichitra Prakashani' and the editorship of Debananda Dam.

1977

The year witnessed the birth of two periodical, which are described, bellow: -

Bijnan Manisha: A monthly periodical on science. It was published from Midnapore under the editorship of Jogen Debnath.

Bijnan o Bijnan Karmi: A bi-monthly periodical on Science, published from Kolkata under the editorship of Rabin Majumder . The periodical is still continuing now.

1978

Vijnan Sankriti: A monthly periodical on science & society, published from Kolkata Under the editorship of Soumen Guha.

1979

In all, two periodicals, which are described bellow, took birth in this year: -

Beta: A quarterly Periodical on Science, published under the auspices of 'The Science Association of Bengal', Kolkata under the editorship of Subhabrata Roychoudhury.The periodical used to have both the Bengali and English version.

Gabesana: A quarterly Periodical on Science, published from Kolkata under the editorship of Ashish Sengupta.

1980.

Six periodicals, which are described, bellow came of in this year:

Homeo Samiksha: A monthly periodical on Homeopathy, published from Kolkata & Dhaka Under the editorship of Dilip Basu.

Prakri Jnan: A popular illustrated bi-monthly journal on natural history, nature study, life & environment Science, published from Kolkata under the editorship of Ajoy Home.

Utsa Manush: A quarterly Periodical on Science & Society, published from Kolkata under the editorship of Ashok Banerjee.

Bijnani: A monthly periodical on Homeopathy, published from Kolkata & Dhaka Under the editorship of Sukla Ranjan Mrinda.

Bijnan Pradip: A quarterly periodical devoted to Science, published under the aegis of 'The Science Association', Behala and the editorship of Shyamal Kumar Das.

Bijnan Sahitya Manthan: A quarterly Periodical on Scientific literature, published from Kolkata under the editorship of Mukul Kanti Manna.

1981

The year witnessed the birth of four periodical, which are described, bellow:

Bijnan Mela: A monthly periodical on science, described in Bengali as 'Chotoder Jnanya Bangla Bhasay Pratham Masik Bijnan Patrika, published from Kolkata under the auspices of 'The Science Association of Bengal'. In the beginning, the periodical was meant for the use of children and the published the editorship of Amit Chakraborty. Later the scope of periodical was widened to be suited by the readers of all ages.it is encouraging to know that the periodical is still continuing its publication, excepting a gap of eight years during 1984-1991.

Kishor Jnan-Bijnan: A periodical devoted to science, targeted to reach to the yongers, published in april 1981 from Kolkata Under the editorship of Samarjit Kar, Rabin Bal, & Jayanta Dutta,. In the beginning the frequency of the periodical was not regular, but demands came to make it a regular monthly periodical. the periodical is still continuing its publication.

Bijnan Club: A monthly Periodical on Science And Science Movement, published from Khantura Gobardanga, 24pgs(n), under the editorship of Dipak Kr. Dan.

Bijnan Samachar : A fortnightly bi-lingual Science Club Magazine, published from Khantura, 24pgs(n), under the editorship of Dipak Kumar Dan.

1982

In all, three periodicals, which are described bellow, took birth in this year: -:

Amader Bijnan Jagat: A quarterly Periodical on Science, published under the auspices of 'Paschimbanga Rajya Pustak Parshad', Kolkata & the editorship of Dibyendu Hota.

Ganit Charcha: A quarterly Periodical on mathematics, published under the auspices of 'Paschimbanga Rajya Pustak Parshad', Kolkata & the editorship of Sibnath Chatterjee.

LokBijnan: This quarterly periodical devoted to Science, society & culture, published from Kolkata under the aegis of 'Lokvijnan Prasar Samiti', Kashinagar ,24pgs(s) and the editorship of Asit Halder

1983

Three periodicals, which are described, bellow have been established in this year:

Bislesan: A quarterly Periodical on Science published under the auspices of 'National Institute of Science & Culture', 24pgs(n), and the editorship of Manibhusan Bhattacharya & Bankim Dutta.

Machh: A monthly periodical on fishing published from Kolkata Under the editorship of S.K.Koner.

BijnanEsana: A monthly Periodical on Science, published under the auspices of 'Saktigarh Vidyapith', Siliguri,Jalpaiguri, and the editorship of Torun Chakraborty.

1984

The year witnessed the birth of eight periodicals, which are described below:

Anwesa: A monthly Periodical on Science, published by 'Vijnan Chetana' ,Kolkata under the editorship of Abhijit Lahiri.

Aryabhatya: A Periodical on Science, Society & Culture, under the auspices of 'Balichak Science Forum', Midnapore, under the editorship of Somnath Roy.

Health Home: A monthly Periodical on health, published under the auspices of 'Students Health Home', Kolkata, under the editorship of Lutful Alam.

Kanad: A monthly Periodical on Science, Society & culture, published from Kolkata under the editorship of Swapan Kumar Chakraborty.

Nabolok: A weekly Periodical on Science, published from Malda under the editorship of Arun Chakraborty.

Samaj o Bijnan : A monthly Periodical on Science movement, published under the aegis of 'Bangio Vijnan Parishad', kolkataand the editorship of Shyamsundar Dey.

Bijnan Niriksha: A monthly Periodical on Science, published from Siliguri, Jalpaiguri under the editorship of Jagadish Ghosh.

Yuga Bikshan: A quarterly Periodical on Science, Society & culture, published from 24pgs(n) under the editorship of Pradip Bose & Tapan Bose.

1985

Two periodicals, which are described, bellow have been recognized in this year:

Nutan Photon : A monthly Periodical on Photography& electronics, published from Kolkata under the editorship of Soumya Mitra & Debasish Banerjee.

Swasthya o Manush: A quarterly Periodical on health, published from Burdwan under the auspices of Sahid Sibsankar Sava Samity.

1986

In all, three periodicals, which are described bellow, took birth in this year: -

EJuger Elektronics: A monthly Periodical on electronics, published from Kolkata under the editorship of Debasish Banerjee.

Jana Bijnaner Isthahar: A bi-monthly Periodical on Science movement, published under the aegis of Paschim Banga Vijnan Mancha', Kolkata.

Ropan: A quarterly Periodical on Science& Literature, published from Kolkata under the editorship of Soumitra Ghosh.

1987

The year witnessed the birth of two periodicals, which are described below:

Adhunik Electronics: A monthly Periodical on electronics, published from Kolkata under the editorship of Debasish Banerjee.

Bijnan Manas: A quarterly Periodical on Science, published from Konnagar , hooghly under the editorship of Durjay Das & Dipak Bhattachrya.

1988

In all, three periodicals, which are described below, took birth in this year: -

Mukhapatra Ganadarpan: A monthly Periodical on Scientific Awareness & Science movement, published from Kolkata under the editorship of Tripti Choudhuri.

Prism: A quarterly Periodical on Science, published under the aegis of 'Gobordanga Yuba Bijnan Sanstha',Khantura, 24pgs(n) and the editorship of Atanu Kumar Dey

Swasthya O Paribesh: A bi-monthly Periodical on health & environment, published under the editorship of Khetra Prashad Sen Sharma.

1989

The year witnessed the birth of four periodicals, which are described below:

Jana Swasthya: The periodical devoted to Helth, published as an organ of 'Jana swasthya Raksha Kendra', Ranaghat, Nadia under the editorship of Subhash Chatterjee.

Kishor Bijnani: A quarterly Periodical on Science, published under the aegis of Paschim Banga Bijnan Mancha',Kolkata, and the editorship of Shyamal Chakrabortty. The Periodical was Renamed in 1993 as Ejuger Kishor Bijnani'.

Neurabi: A quarterly Periodical on Science& Literature, published from Kolkata under the editorship of Kanailal Banerjee.

Bijnan o Samaj: A monthly Periodical on Science & Society, published under the aegis of 'Haldia Bijnan Parishad', Midnapore and the editorship of Debdash Mukherjee.

1990

Two periodicals, which are described, bellow have been established in this year:

Bijnan o Prajukta Mela: An annual publication featuring different events of scienc& technology fair, organized by Gobordanga Renaissance institute, Khantura, 24pgs(N).

Bijnan Prajukta o Pragati: A quarterly Periodical on Science & technology published under the support of 'Dept. of Science & Technology,Govt. of West Bengal, Bikash Bhavan, Kolkata'and the editorship of Sdabyasachi Guha & Sankar Chakaborty.

1991

Yuktibadi: A quarterly Periodical on Science& Rationalism, published from Kolkata.

1992

The year witnessed the birth of two periodicals, which are described below:

Arogya: A periodical devoted to Health & Medicine, published under the auspices of 'Social Health & Science Forum, Durgapore and the editorship of Bimal Das.

Quark: It is a bi-monthly periodical on Science, started publication under the editorship of Bijan Sarangi. The Perodical is Published from jhargram, Midnapore. The new series under the title 'Top Quark' appeared in February-March, 95. apart from Popular Science articles, essays an Socio-political and Socio-economic issues have also been covered in this periodical.

1993

In all, two periodicals, which are described bellow, took birth in this year: -

Prakritik Chikitsa: A quarterly Periodical on natural medicine, published under the support of 'Gobordanga Prakritik Chikitsa Mission', Khantura, 24pgs(N) and the editorship of Nirendralal Guha.

Swasthyer Sandhane: A forthnight periodical devoted to Health, published from Kolkata, under the editorship of Sristidhar Debnath..

1994

The year witnessed the birth of three periodicals, which are described bellow:

Prakriti: A quarterly Periodical on Science, nature & environment, published in Aug-Oct, 1994 under the aegis of 'Midnapore Science center' Midnapore under the editorship of Saibal Roy.

Prakriti: A bi-monthly Periodical on Science & Society, published under the editorship of Soumitra Banerjee.

Swasthya: A monthly Periodical on health, published from Kolkata.

1995

In all, two periodicals, which are described below, took birth in this year: -

Swasthya Bikash: A quarterly Periodical on health, published by 'Medical Service Service Centre', Kolkata.

Prakriti: A monthly Periodical on Science, published under the guidance'Break Throu Science Society' and the editorship of Subhasish Maity.

1996

Six periodicals, which are described, bellow have been established in this year:

Ebong Ki o Keno: A quarterly Periodical on popular Science, published under the aegis of 'Murshidabad Zila Bijnan Parishad', Murshidabad.

Ganit Anwesa: A quarterly bi-lingual (Beng-Eng) Periodical on Mathamatics, published from Baruipur, 24pgs(s) under the editorship of Abdul Halim Sekh.

Krishi Barta: A quarterly Periodical on Agriculture, published under the aegis of Vidhan Chandra Krishi Viswabidyalaya,Kalyani, Nadia, and the editorship of Dibyendu Sen.

Prayukti: A monthly Periodical on engiaring & technology, published by Ramkrishna Mission Shilpa Mandir', Kolkata & sponsored by Ministry of Human resource Development, Govt. of India, under the editorship of Binod B. Pal.

Prakriti O Bishwa: A quarterly Periodical on Science, nature & environment, published under the aegis of ' Science center Gol Kuachak' ,Midnapore under the editorship of Saibal Roy.

Sabuj Barta: A quarterly Periodical on Science & Nature, published under the aegis of 'Jadavpur Vibek Nagar Nature Lovers Association', Kolkata and the editorship of Tarak Nath Bhattacharya.

1997

The year witnessed the birth of six periodicals, which are described, bellow:

Computer: Thatya o Prayukti- A monthly Periodical on Computer Science & information technology, published from Kolkata the editorship of Indira Bhattacharya.

Ekush Sataker Yuktibadi: A bi-monthly Periodical on Science, published under the support of 'Bharatiya Bijnan o Juktibadi Samity' , Kolkata and the editorship of Debasish Bhattachrya

Gana Bijnan Barta: The monthly periodical devoted to Science movement 'published from Kolkata under the editorship of Subhash Chatterjee.

Gana Vijnan Charcha: A Popular Science magazine(5 issues in a year) published under the aegis of 'Jhargram bijnan Parishad', Midnapore .

Masik Computer o Electronic Jagat: A monthly Periodical on Computer Science, electronics & information technology, published from Kolkata under the editorship of Debasish Banerjee.

Prani Palaner Darkari Katha: A monthly Periodical on Vetenary Science, published from Kolkata under the editorship of PradipKumar Das.

Chaser Katha: A quarterly Periodical on Agriculture, published under the aegis of development Research Communication & Services Centre', Kolkata and the editorship of Subrata Kundu.

1998

In all, six periodicals, which are described below, took birth in this year: -

Computer & Telecon: Today & Tomorrow: A multi-lingual(Beng-Eng-Hindi) Periodical on Computer Science & information technology, published from Kolkata under the editorship of S.K.Pandey.

Ekuush Sataker Bijnan: A Periodical on Science, published under the aegis of 'Bjnan o Sanskriti Gabeshana Kendra, Kolkata under the editorship of Amitava Dey.

Kishor Yuktubadi: A bi-monthly Periodical on Science & science Awareness, published by 'Bharatiya Bijnan o Yuktibadi Samity, Kolkata, under the editorship of Rajesh Dutta & Debkumar Halder.

Medical World: A weekly Periodical on Medical Science, published fromKolkata, under the editorship of Jayanta Chatterjee.

Sustha: A monthly Periodical on Health, published by Aajkal, Kolkata, under the editorship of Ashok Dasgupta.

Swasthya O Chikitsa: An annual (1st july, every year) Periodical on Health, published by Ganashaktil, Kolkata, under the editorship of Anil Biswas.

1999

Two periodicals, which are described, bellow have been established in this year:

Spandan: A half yearlyPeriodical on Science, published from Raiganj, under the editorship of Utpal Dutta & Kaushik Dutta.

Tabe Ki Khabo: A Periodical on Science, published under the aegis of 'Bijnan Mansikata Vikash Kendra,
Kalyan garh, 24pgs(N), and the editorship of Bankim Chakrabortty.

2000

The year witnessed the birth of three periodicals, which are described below:

Batayan: A Periodical on Science,society, & culture, published from Kolkata under the editorship of Subhash Chandra Sarkhel..

Chayan: A Periodical on folk and traditional science& technology, published under the aegis of Nodal Research Centre, Kolkata, and the editorship of Amitava Sen.

Prithibir Disha: A monthly Periodical on Science for Children, published from Kolkata, under the editorship of Malabi Gupta.

During the span of the time the periodicals appeared mostly under the sponsorship of Science Clubs & Association of Local & state levels. Few have been under the government and Individual initiatives. From the Available information it has been found that the periodicals are of weekly, fortnightly, monthly, bi-monthly, quarterly, semi annual, half yearly, annual frequencies. But mostly they are of either monthly or quarterly besides the short-lived periodicals; long lived-periodicals have also been identified in this era. Though, some of these periodicals have ceased their publications, some are still being published. For example Jnan O Bijnan, Manabman, Sarsamachar, Chas Bas, Swasthya Dipika,Vijnan o Vijnan Karmi, Vijnan Mela, Kishor Jnan Bijnan etc. are still living and have been published more than two decades. Again, most of the periodicals have been published exclusively in Bengali, Some Are bi

–lingual or multi-lingual. One more striking feature is that through some of the periodicals have been operated under the same title –their frequency, place 7 year of publication, publishers, editor etc are quite different., Lokbijnan(monthly) reported in 1975, was published by Howrah Bijnan Parishad under the editorship of Sushil Kumar Mukherjee and Lokbijnan (quarterly) reported in 1982, was published by Lokbijnan Bijnan Parsar Samity under editorship of Asit Halder are relevant to be mentioned here. Again Prakriti (quarterly) reported in 1994 was published by Midnapore Science Centre under the editorship of Shaibal Roy & Prakriti (bi-monthly) reported in 1994 was published Kolkata under the editorship of Soumitra Banerjeeare also worthy to be mentioned here.

Radio is not only the source of entertainment but also a medium for non-formal education. Talking about radio in Bengal essentially refers to Akashbani, Kolkata. The science section of All India Radio, Kolkata ushered its day in mid 1976.Dr. Amit Chakroborty was designated as the Science Officer with two assistants namely, Dr. Ashok Bandyopadhyay and Krishna Ghosal. On the occasion of Scientist Satyendranath Bose's Birthday the science section announced different programmes on science. Kolkata station of All India Radio started a regular programme on science every Thursday at 8p.m.Programmes like Bijyan Jigyasa,Anwesha used to be broadcast in this particular segment.It is noteworthy that Anwesha is broadcast on Saturday instead of Thursday on Kolkata 'A' channel from 8.00 to 8.30 p.m.In the mid 80s India Government took initiatives to communicate science in a better way and thus formed Jatiya Bijyan O Projukti Prachar Parishad. This parishad produced a series of science programmes, beginning in 1989 where inter-personal communication and science communication were simultaneously emphasized. The FM section of All India Radio,Kolkata broadcast science programmes on every first, third and fifth Friday of Every month from

10 to 12 o'clock since 1994.

Among the Bengali newspapers there are three, which regularly publish a weekly special page on Science.

'Kalantar', which was previously known as 'Swadhinata', publishes 'Prokiti O Manus' every Monday; 'Bartaman' publishes the science page titled 'Bigyan Bichitra' on Tuesday regularly. 'Bigyaner Khabor" –of 'Ganashakti' which comes out on each Monday definitely flags the theme of science popularization. Besides 'Dainik Statesman' affords half-page on every Thursday named 'Anubikhyan' for science news. Other newspapers though not having a special page on science have importance in science communication.

As an electronic media Doordarshan and other private TV channels serve a little bit for science communication in comparison with radio. Programmes like 'Bigyan Prosonge','Swasthya Jigyasa','Bigyan Quiz', and agricultural issues used to be telecast on Doordarshan. Programmes related to health and hygiene is also telecast on Doordarshan for e.g. 'Hallo Doctor'. Other private Television channels telecast a very little bit science based programmes; rather they have been interested to telecast programmes on occult, astrology and also serials instead of any science programme due to TRP factor.

After the independence, new born India government felt that science is necessary for the over all development of the common people and this thinking was recognized by framing the directive principles of our constitution. Article 51(A) (h) says that it is the duty of all citizens "to develop scientific temper, humanism and the spirit of inquiry and reform." To fulfill this duty the scientific knowledge should be disseminated. More over, the Right to information Act which is enacted on June15, 2005, speaks of the citizens right to get information which has been defined as material in any form, including records, documents, memos, e-mails, opinions, advices, press releases, circulars, orders, logbooks, contracts, reports, papers, samples, models, data material held in any electronic form and information relating to any private body which can be accessed by a public authority under any other law for the time being in force. So science news is easily access able for the common people who interested in science. To grow awareness in the mind of the people the schools are the starting point. Mere cramming of facts and theories without laboratory work was a dull affair and the students could not develop a genuine interest for the subject. The Government of West Bengal accepted the truth in its official publication that science is being taught but the students cannot grasp it. To attract the common people about the science and technology a science museum is to be needed- this fact was realized by the chief minister of West Bengal of that time, Dr. Bidhan Chandra Roy. A science museum, the first of its kind in India was set up in nowhere else but West Bengal in the year of 1959. Both the Union and the State governments took up this project under the initiative of the Chief Minister Bidhan Chandra Roy. Ultimately, on 2nd May, 1959 the museum was inaugurated by Humayun Kabir, the Union minister for scientific research and cultural affairs. Name of the museum was given the Birla Industrial and Technological Museum that is popularly known as B.I.T.M. It had brought up a new mode of science education for the common mass. It was non-formal in character but immensely effective in function. After its emergence, B.I.T.M played a major role in the multi-faceted working domain of science movement. It showed that science could be popularized as a way of info-tainment. It had asked the common people and the students to enjoy and explore the fun and excitement of the world of science.

Meanwhile, in the year of 1958, an important policy decision was announced on the part of the Union Government. That was the Scientific Policy Resolution, declared in the Loksabha on 4th March 1958, which was emphasized on the development of scientific temper through the use of scientific approach and scientific methods for achieving the goal of prosperity. In 1956 the Union Government had taken the matter seriously and it was first seen that Scientific Advisory Committee to the Cabinet (SACC) was formed under the leadership of Dr. Homi Jahangir Bhaba. After working ten years, the committee was renamed as the Committee on Science and Technology (COST). In 1971 it was transformed further into the National Committee on Science and Technology (N.C.S.T) and it was again reformed in 1975. The scientific organizations in India could be divided into two parts – Task coordinator body and Task implementation body. The National Council for Science and Technology communication (N.C.S.T.C) or Rastriya Vigyan Evam Prodyogiki Sanchar Parishad under the department of Science and Technology, Government of India being came into existence in 1982, to communicate scientific knowledge and to inculcate scientific and technological temper among masses. In 1990, India Government was taken a new programme, namely- Mass Action for National Regeneration (MANAR). It was said that Bharat Jan Gyan Vigyan Jatha (B.J.G.V.J) would be a nation wide mobilization leading to MANAR as its ultimate goal. Apart from N.C.S.T.C in 1989, as an autonomous registered society, the department of science and technology to take up large-scale science popularization projects established another governmental organization- Vigyan Prasar.

Laterally the Government of West Bengal took initiatives to popularization science in the mid of 70s. On 14th October 1974 Satyendranath Basu Bijyan Sangrahashala O Hate-Kalame Kendra (Satyendranath Basu Science Museum and Experiment Centre) was established in Bangiya Bigyan Parishad. Later the change of political ambience in West Bengal some how affected the science movement. At that time, there was no science department in West Bengal. As a neglected sector, West Bengal Science and Technology Committee under the Development and Planning Department had monitored scientific works. Finally in March 1988, after the amendment of the Rules of Business of the state government, the Science and Technology Department was created and in June 1988 the department was started it's functioning. Two months later, an advisory council was formed as the State Council for Science and Technology under the scheme ("Assistance for development of State Council fir Science and Technology") of the Sixth five-year plan. The main objective behind the formation of this state council was to set a focal point for the formulation, planning, coordination and enhancement of science and technology activities within their respective states. But problem was that though it was an advisory body without any autonomous character or executive power, it had no option to make any financial decisions to execute the scientific and technological schemes. Both the science and technology department and council had very much depended on outsourcing of money. Even they did not disburse the funds offering by the government of India. Under this circumstances the state council of science and technology in its 5th general meeting held on 10th December1990 under the chairman ship of the chief minister, took the decision to boost up the council by granting some sort of financial autonomy for effective execution of the time-bounded schemes. Accordingly, following the guidelines of the West Bengal Societies Registration Act a draft memorandum for the West Bengal State Council for Science and Technology had been prepared and finally, the council was registered on 14th October1993. Then a new dimension came into the field of science and technology popularization in West Bengal. The very next year the state council arranged the West Bengal State science and technology congress, which was very important for the science movements. In this congress, scholars got the opportunity to present their research work in the vernacular. The work of the science department also reflected the eagerness of the state government to do the work of science popularization with the various active organizations of the state in a collaborative manner. So in

1990, West Bengal Science and Technology department observed the National Science Day jointly with the eighty-six science clubs of West Bengal. In the budding condition, Paschimbanga Bijnan Mancha arranged its first state conference on 19th and 20th March, where in the presidential address Mr. Shankar Chakraborty said that the role of Science and Technology Department of Government of West Bengal was very praiseworthy in its endeavor to solve the scientific and technological problems of the rural community. Another remarkable step of the Government of West Bengal is starting the two science related award. One is the Meghnad award and another is Satyendra award. Since 1995 Meghnad award had given to recognize the role of science organizations in directing the scientific activities for the people. On the other hand Satyendra award is exclusively for the writer who had written a particular book on science for the adolescent. Thus the both union and state Government had given patronage and had started to play the role of a collaborator in the field of science popularization in West Bengal.

Science is written records of man's understanding of nature and that is why to make science, technology and society synchronize, we have to make science more meaningful and technology more human-oriented. Science popularization means the transmission of scientific knowledge from scientists to the lay public for purposes of rational thinking. India Government has already declared year 2004 as the 'Year of Science Awareness', when the importance of science communication cannot be ignored. It is regretting that simultaneously occult, astrology is getting importance. Religious education and astrology are sometimes included within the syllabus. But people who are really progressive definitely intend to teach the present generation utilizing the scientific methodology of communication. Science is the only one, which can remove all the barriers logically and practically.

But unfortunately we still find in the state like West Bengal various types of superstitions, pseudoscience and deep-rooted religious dogma still prevailing in the society. So Pulse Polio campaign was not successful in various parts of the state due to lack of science awareness. Illiteracy, poverty and lack of science awareness campaign according to need are the main hindrance of science movements in Bengal. Science has developed while scientific bend of mind lags far behind. Science therefore has only a limited influence on the society. Though science communication has developed but this is not enough according to big population. Finally the science popularization movement has taken acceleration in the mid of 70s in West Bengal. So we lost many times after independence. But better late than never. During '80 onwards several pro-people science groups came up in action in different districts of Bengal. It is observed that the science movement is mainly concentrating in urban areas, more specifically in Kolkata. Though many science groups (like Drug Action Forum, Bigyan O Bigyankarmi, Manas, Ganabigyan Samanyay Kendra, Ganadarpan, Norman Bethune Janasasthya Andolan, Bharatiyo Bigyan O Juktibadi Samity, Canning Juktibadi Sangskritik Sangstha, Paschimbanga Vigyan Mancha etc.) came into existence to penetrate in the villages and gaining lot of supports from the local mass. Impact of science movement, science communication on society might be low at present but the dream is high. In the context of present darkness in social justice, awareness and equality, one can find the glimmer of dawn- a new hope ahead through this People Science Movement in West Bengal.

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188. Scientists and Popular Science Books–The role of Scientists in Science Popularization

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Abstract. It is a social responsibility for scientists to popularize scientific knowledge in the public. Books are one kind of media to popularize science, and scientists trust and know it very well. So far, books have been playing an important role on helping scientists to promote the pubic understanding of science. In the paper, at first, the author reviews and analyses the position of the popular science books, the role of scientists in publishing popular science books as well as the mainly collaborating way between scientists and publishers in science communication in China. The author points out that under the buffet of new media and high technology of science communication, scientists should pay more attention to publication of popular science we called as a traditional media. Facing ever-increasing interests and demands to scientific knowledge from the public, we should strengthen the interaction and contacts between the public and scientists through the media of popular science books.

In the paper, the author provides us with some cases and practical examples to explain no matter whether scientists are authors, recommenders or leading characters in the popular science books, they can produce or form favorable models of science communication through which readers are close to science and understand science. Finally more and more people are attracted by glamour of science. In the meantime, the author emphasizes that comparing with male scientists, when taking up science education or work on science popularization, female scientists will have a distinctive advantage because they have both the meticulously rational thinking and the character of maternal love with mildness and patience.

189. Trends in Climate Change Coverage in India: A Case Study of Three Leading National Newspapers in India

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Abstract. Climate change and environmental risk is one of the major issues in the twenty first century. Intergovernmental Panel on Climate Change (IPCC) has asserted serious concern over anthropogenic climate change in various times. Complexity of environmental issues, comprehension gaps for these matters and language of science topic stands as barrier between mass audience and the matter itself. Mass media undeniably is the major role player in stimulating public debate and shaping public opinion on scientific questions and issues as well as in policymaking process. In this paper, coverage of climate change in three leading newspapers of India has been analyzed since February 2005 to January 2010. The study includes qualitative and comparative content analysis of three major English dailies of India–The Times of India, The Hindu and The Indian Express. Order of the journalistic norms for presentation of this global issue has also been analyzed. This study also reflects public-participation throughout the time span that takes in to two major events in climate change movement–Kyoto protocol and Copenhagen summit.

190. Climate Change as Stop-Motion Films

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Abstract. This paper is about how to make upper secondary school students communicate climate change issues by developing stop-motion films in a cross-disciplinary teaching environment involving the subjects biology, geography, social science, Danish and arts. Inspired directly by the 'Images of Science' session and the Copenhagen Challenge at the PCST 9-conference in Copenhagen/Malmø, LIFE The Faculty of Life Sciences at University of Copenhagen initiated a project about how to make young people communicate climate change issues using popular media.

Two upper secondary school classes worked with climate change for a week. They met researchers working with bio fuel and CO2 credits, they worked with the topics in geography and biology, learned about discourse analysis in social science, comic movies as a genre in Danish and arts and ultimately produced short stop-motion films about climate change. The films were all uploaded on YouTube.

The project was carried out in cooperation with Sankt Annae Upper Secondary School in Copenhagen–a secondary school renowned for giving students an opportunity to develop their skills both academically and in the creative (especially) musical arts. The project was supported financially by the Danish Ministry of Education and was followed up by detailed didactical descriptions (on the Internet) in order to make it possible for other teachers to conduct similar cross-disciplinary projects linking science and the arts. Following are some links to film examples:

http://www.youtube.com/watch?v=LXTXVay4JGg (Danish speak, will be re-recorded in English)

http://www.youtube.com/watch?v=STnmuOXaIjM
More: http://www.sag.dk/sag-nyt/index.php?id=268

191. Communicating Science: Through Mass Media to Masses

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Abstract. Communicating science through mass media is not like communicating or covering other subjects or beats. It carries not only information but also an attitude, a temperament and a way of life that is conducive to a rational living. Today the challenge before the science communicators is even greater with the development of technology and new media. The biggest challenge before a science journalist is how to communicate science related information to its receivers with clarity and understandably in such away as it percolates to the masses. The basic purpose of science communication is not only to tell the masses what is scientific and what is superstition, but also to develop among them the scientific temperament, a scientific approach to the things enabling them to decide themselves what is rational and what irrational, what is acceptable logically and what is to be abandoned as rubbish. It is enabling the masses to be patient and innovative in time of crises. Though the rapid developments in the field of information technology, biotechnology and also medical sciences, have led to considerable increase in popular science writing and coverage of science related events over the years, but we have miles to go to make our popular science writing qualitatively acceptable.

Keywords: Science, Mass media and masses

192. Impact on Policy through Science Journalism–Evaluating **SjCOOP, a Capacity Building Programme for Journalists in Africa and the Middle East**

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Abstract. The SjCOOP-project builds the capacity of science journalists in Africa and the Middle East. It establishes peer-to-peer mentoring-relationships and also supports new national and regional associations of science journalists. In its first phase, between 2006 and 2009, the project yielded numerous outcomes which indicate that a push in the professionalization of science journalism has been achieved. The evaluation of the second phase of SjCOOP now lays an additional focus: It aims at assessing the impact which specific articles or broadcasts may have on the public agenda and on governments' decisions and policies.

Keywords: Media development, Journalism impact, Mentoring, Outcome mapping, Agenda setting

Introduction

Capacity building programs for better science journalism in developing countries have in the past been generally driven by governments concerned with science literacy or institutions aiming at making sure journalists would transmit the right information regarding specific issues like AIDS, bird flu, climate change, GMOs, and countless other important issues. The means used have then been limited to either academic courses at universities or to short term training activities. In most of these activities students or journalists are trained for a short period of time on how to report on environment, health, technology and science. Evaluation of these activities and their outcomes are usually very limited, if at all existent and journalists are usually passive recipients of the training or information.

In this paper the structure and evaluation framework of SjCOOP ("science journalism cooperation") is described, a long-term support-programme for science journalists in Africa and the Arab World. An initiative by the World Federation of Science Journalists (WFSJ) this project is managed from its headquarters in Canada in close cooperation with regional coordinators in Africa and the Arab World. It is funded by major international donor organisations: the British Department for International Development (DfID), the Canadian International Development Research Center (IDRC), the Swedish International Development Agency and the Dutch Ministry of Foreign Affairs. Science journalists, in general, face a number of professional difficulties inside as well as outside their media organisations (Bauer/Howard 2009, Lublinski 2011). The starting point of SjCOOP is the idea that science journalists in general are willing to help, cooperate with, and support their peers worldwide (Fleury 2008). The aim of SjCOOP is to build an international network of colleagues and to enable a critical mass of science journalists overcome their problems, advance their careers, take the initiative in their own training, and take their stand in developing countries.

In order to achieve this goal a number of activities are carried out, including dedicated monitoring and evaluation. The objective here is to build a learning culture into the project and also to understand certain change-processes in the newsrooms and beyond.

SjCOOP has run a first phase from 2006 and 2009. A second phase of the project (from 2010 to 2012) has just begun. In the following past achievements as well as new plans are discussed.

Mentoring Science Journalists

Through the SjCOOP-project 15 experienced science journalists (mentors) are linked to 60 aspiring science journalists (mentees). While all the mentees come from developing countries, half of the participating mentors come from developed countries. All participants are divided into three regional groups: anglophone Africa, francophone Africa and the Arab World. Each group is led by a regional coordinator, coming from Nigeria, Cameroon and Lebanon respectively.

In peer-to-peer relationships each mentor-mentee-pair develops individualized plans of action for support through coaching and consultancy. Mentor and mentee discuss, face-to-face or by electronic communication, the contents of manuscripts the mentee has written. They also exchange on research strategies, questions of career advancement, networking, etc.

These relationships are supported by a number of additional activities and tools: once a year face-to-face meetings with trainings and field trips are offered. Web-based resources and networking-opportunities are supplied: a dedicated online platform for exchanges among the participants and discussion groups, and press conferences organized on skype. Also the building of international teams of reporters is encouraged: joint research and publication projects are carried out on selected topics.

Another important resource is the world's first Online Course in Science Journalism (WFSJ 2008) which has so far been translated to seven languages. It covers major practical and conceptual issues in science journalism, such as how to find and research stories, exposing false claims, how to pitch to an editor, turning crisis reporting to advantage and so forth – topics that are relevant to beginners in journalism as well as more experienced reporters and editors in all regions of the world. The authors of the course are journalists from many different countries. A large number of mentors and mentees of the SjCOOP project are involved in developing and improving the course (Clayton/Lublinski 2008).

Overall the SjCOOP project supports journalists while they stay in their normal working-environment: They keep their jobs in their newsroom, carrying out their regular duties while benefitting from the support provided by the project. Instead of being taught in an artificial training setting often by outsiders to the profession, SjCOOP-participants are helped to grow on their job by colleagues. Improving one's skills becomes part of the professional attitude, a sine qua non for a successful career in science journalism.

Some SjCOOP Mentoring Results

During the first three-year phase of this project numerous outcomes have been achieved. Among them are 12 new science beats that have been established by the participants (science desks, science pages or special science broadcasts on TV or radio, and a new pan-African science magazine using mentees as correspondents). 22 mentees have won a total of 44 awards (prizes or scholarships), among them three scholarships for the prestigious Knight Science Journalism Fellowship at the Massachusetts Institute of Technology. 15 mentees have been promoted to higher positions in their own media, 18 have started to freelance internationally (WFSJ 2009).

Association Building

As a second core activity the SjCOOP project helps African and Arab journalists in founding new national and regional associations of science journalists. Consultancy is given for setting up constitutions, fundraising and partnering with long-established associations of science journalists in rich countries. In the course of the first phase of SjCOOP eight new associations were formed and have all proven to be active in supporting science journalists.

SjCOOP supported associations through the partnering, or "twinning", of newly established science journalists' associations with long-established ones. One example is the twinning between the Arab Science Journalists Association which was established in December 2006–with the National Association of Science Writers in the United States, which was established in 1936. As a result of this cooperation the 7th World Conference of Science Journalists will be held between 27th and 29th June 2011 in Cairo, Egypt.

Another example is the twinning of Cameroon's science journalists' association with France's Association des journalistes scientifiques de la presse d'information. In addition, Kenya has been twinned with the Canadian Science Writers' Association, Nigeria with Germany's Science Journalists' Association, and Uganda with the Association of British Science Writers.

In its second phase SjCOOP supports these new associations by providing means for the organization of select activities such as training workshops and attending conferences.

Evaluation with "Outcome Mapping"

A development project of the size of SjCOOP needs a dedicated framework for evaluation and learning. In the first phase of the project, Outcome Mapping has been used: an integrated method of planning, monitoring and evaluation which has been specifically designed for capacity building in complex developmental settings. It provides for a participatory process that builds a culture of organizational learning and evaluative thinking into a project (Earl/ Carden/Smutylo 2001).

The main focus of Outcome Mapping is to measure changes in the behaviour of people and organisations with which a development initiative works with most closely. So according to this approach it is not enough to create information, disseminate it and raise awareness. It is the action people take that counts; in other words behavioural change that can be observed through a monitoring and evaluation process. These measured "outcomes" of the project's partners are considered to be a guiding "map" in the complex, changing and at least partially unknown territory the project team chooses to be active in.

In the case of SjCOOP, the project team works with three groups of beneficiaries ("boundary partners"): the mentors, the mentees and the national associations of science journalists. Long lists of actions or behavioural changes ("progress markers") were suggested, revised and adapted several times. In the case of the mentees, for example, the project works with some 20 "progress markers", which include a wide range of outcomes indicating that a certain change process is actually happening, e.g. "finding a way to regularly access the internet", "improving their writing skills with the help of the mentor", "applying for journalism awards", "creating science beats or new science media".

A selection of these "progress markers" was being monitored during the first phase using a number of different methods: mentees were interviewed on the phone, mentors filled in questionnaires regularly on their work and the progress of their mentees. The content of the mentee's articles/broadcasts were evaluated by external journalists. Also editors-in-chief were interviewed by evaluators as well as the scientists or experts the mentees had interacted with. It is through the combination of these methods that the project team is able to understand data, learn where the difficulties of the project are and take decisions based on insights from different angles (El-Awady/Lublinski 2008).

Evaluation with "Logframes"

The evaluation framework of the second three-year phase of SjCOOP, which started in 2010, is now combining the methodologies of "Outcome Mapping" and "Logframe Analysis". The idea here is to use and maintain the processes and results of the first phase while at the same time better meeting the donors' requirements for rigor and accountability in evaluation. It turned out that having gone through a creative and flexible first phase was very useful for defining a complex logical framework matrix. Here the theory of change is described by a set of levels that describe possible outcomes and impacts of the intervention on different levels. Having built the project with Outcome Mapping made it easy to find meaningful logframe indicators to be measured in the second phase.

In addition to this new framework some new Outcome Mapping elements are developed: Each mentor-mentee pair is encouraged to develop their customized mentoring plan by defining individual "progress markers". Also for the new associations of science journalists new, individualized plans of action and outcomes are being set up.

Overall this new synthesized framework brings the opportunity of evaluating the process as well as the results of SjCOOP in a participatory, flexible and yet scientific way, based on a testable theory of change, as described theoretically by Roduner/Schläppi/Egli (2008).

New monitoring activities which are carried out in the second phase include (on top of the ones described above in section 5.): analysis of the opportunities for science journalism in the media the mentees work, assessment of the professional level of mentors and mentees as well as gender mainstreaming.

On top of this, two new evaluation activities are under way which are especially demanding: The quality of the mentee's articles and broadcasts will be assessed through scientific content analysis and the impact of specific stories/ articles on the public agenda and on the change of policies will be assessed in a limited number of cases. These two elements require their own communication research projects which will be outlined below.

Measuring journalistic quality

In the second phase of SjCOOP the articles and broadcasts produced by the mentees will be evaluated at various times in the course of the project. This assessment should reveal progress in terms of journalistic quality. In order to discover reasons for this progress, data on interfering variables (e.g. training, the editorial environment and structure of the newsroom, media freedom) will be compiled.

The judgements on the journalistic quality will me made on the basis of quantitative and qualitative content analysis of manuscripts, a method previously established through the evaluation of other media development projects (Spurk/Keel/Lopata 2010). In order to account for the counterfactual also manuscripts written by journalists who had applied to be SjCOOP-mentees but have not been selected will be analyzed also.

As a basis for this evaluation a quality criteria catalogue has been established at the outset of the second phase of the project. The idea here is to decompose the general notion of quality into smaller units, i.e. quality criteria. Although many quality criteria may be overlapping or differ according to media genre, target group or editorial preferences there are some core fundamental quality criteria for journalism that can be agreed upon.

The quality catalogue for the evaluation of SjCOOP has been assembled from three sources: 1. guide-lined interviews with the mentors, 2. an analysis of the Online Course in Science Journalism and, 3. a review of the literature on quality in journalism and science journalism (Blum/Knudson 1997, Arnold 2008, Hettwer et al. 2008, Brake/ Weitkamp 2010, to mention only a few authors here.).

The interviews yielded a good consensus among the mentors on the following criteria for journalistic quality (which were in accordance with the online course and can also be found in the literature): diversity of sources, diversity of viewpoints, adding background to a story, correctness of information, citizens as main obligation for reporters, audience adequate writing style and the use of other ‘transformation’ techniques to improve the comprehensibility of an article or broadcast. This catalogue has been agreed upon by the mentors as well as the SjCOOP-staff and will be used as the basis for the evaluations to be carried out in the course of the project.

Impact Stories

In the first phase of SjCOOP we saw the production of a small number of journalistic stories in news media which led to societal dialogue and in some cases government decisions in developing countries. Three examples shall be given here:

A mentee from Cote d’Ivoire published a dossier on the reintegration of people who have been displaced by war and lack psychological support. In doing so he stirred discussions in his country, the ministry of war victims contacted him to let him know they were lacking money to carry out the plan of action they had originally intended to follow.

Another mentee’s article published in a major daily newspaper in Uganda focused on expired anti-retroviral (ARV) drugs distributed by government stores and leading to death. As a consequence of this journalist’s report the director of the ARV distribution scheme lost his job.

A mentee from Cameroon led a team of journalists that highlighted the lack of progress in extracting the carbon dioxide gas accumulating in infamous Lake Nyos. The reporting was instrumental in triggering the implementation of remedial measures.

So far these and other cases have provided anecdotal evidence for societal change processes in which science journalists played an important role. Yet, they have not been studied or evaluated in detail. These results were unintended outcomes: the project, in its first phase, was not directly aiming at achieving them.

In its second phase, the SjCOOP project will lay a main focus on these «impact stories» both in its programme management as well as in the accompanying evaluation and research activities. In a few selected cases we will try to understand the influence certain science journalism stories have on public discussions, attitudes of the general public and the reactions by public policy in terms of policy change.

The anecdotal cases reported in the first phase of SjCOOP nicely fit in the three varieties of policy effects identified by Protess (1991): deliberative results (debate on war victims), individualistic results (firing of AIDS drug officer), and substantive reforms (lake Nyos). Further research is needed to add to and describe these cases in detail.

Conclusions

A true push in the professionalization of science journalists in Africa and the Arab World has been achieved through the first phase of the SjCOOP project. The blending of different activities on different levels (face-to-face meetings, individual mentoring, reporting teams, association building, use of dedicated tools on the internet) has led to numerous outcomes that show the progress of the projects’ participants and science journalism in general. This progress is being achieved while the supported journalists stay on their job: they are trained «in situ».

This project can also serve as an example for the synthesis of the Outcome Mapping and Logframe Analysis approaches for evaluation. In order to plan, monitor and evaluate this complex capacity-building project a combination of management and evaluation tools for development as well as communication research is needed. This holds especially true when it comes to studying the impact some dedicated science journalistic stories may have. The results, we hope, may lead to new approaches in evaluations of media development projects as well as research uptake programmes.

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193. Daisy Communication of Scientific Fact through **Advertisements in Indian Media**

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Abstract. Media is playing vital role in education, awareness and entertainment, even idiot box is also enjoying the warmth of communication in contemporary communication arena. TV screen is capturing minds and mood of the audiences, in the manner that each and every pattern of our life is being affected by the media interface. In this media progressive world the communication about science and scientific fact are being adopted by the audiences in the manner they are being shown on the screen. This paper will dissect and analyze the science communication through advertisements which are creating a daisy information environment. If media can create a wave of positive communication then a daisy communication can harm audiences as well. In this paper it has been analyzed that the science communication through advertisements has given them a platform to accesses new information about scientific facts. Now it is responsibility of a communicator, that the information which is being circulated through advertisements should not create any miss information are any dilemma in the minds of audiences. Advertising communication is the key player in the field of mind & Mood management. This paper will give a view of acceptability of communication approach through the promotional communication and also give the acceptability of the scientific facts and their impediments on the societies. It has been raveled that so many advertisements of the contemporary media reflects so many medical facts, although they are awaking common man about science but not in the proper prospective. Audiences are being fool with facts given in the communication. They are using medicines without prescription of a doctor. So many shampoos and FMCG are being used in the impression of scientific fact. Such communications are not confined for the Medicines and cosmetics but also for the lubricants, child food stuff, pet's food, automobiles etc are being sold with the help of science. Yes it is true that, such communications are making audiences aware about science and science communication but on which cost. On the unsatisfactory performance of the product in the mind set of the audiences. It has been revealed that if audiences will be annoyed by such daisy communications, science will become a hard nut for them and again communication about same will be a tough task. In fact Indian audiences are not so much matured that they can analyze the wrong and right prospective of the communication and the impact of the same. So, the communication especially science communication in advertisements are very daisy and rather than communicating a proper image of science, companies are cheating their audiences in the name of science. No doubt this approach is affecting the real media world as well as the science communication stream. This paper will not give only the picture of daisy science communication in advertisements but also suggest a way to meet with the consequences of the communication.

Keywords: Communication, Advertisments, Audiences, Daisy communication

194. Saúde, Educação, Cidadania, Jornalismo Cientifico, **Popularização da Ciência**

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Abstract. Neste trabalho busca-se relatar a experiência de pouco mais de dois anos do programa de rádio Saúde com Ciência, da Universidade Federal de Minas Gerais. Sob o slogan "A informação a serviço da qualidade de vida", adotou-se o estilo jornalístico como forma de expor o conhecimento científico sobre saúde produzido na universidade pública diretamente ao cidadão comum. O objetivo esperado é que desta forma este público tenha acesso a informações úteis, apresentadas de uma forma curiosa e bem humorada, com vocabulário simples, e que tratem de questões por vezes complexas relativas à promoção da saúde, prevenção de doenças, hábitos, direitos, normas de funcionamento do Sistema Público de Saúde, deveres, cidadania, conceitos e comportamentos saudáveis. Por sua vez, esperamos que a partir dessa conscientização cidadã o ouvinte possa se posicionar melhor na busca pelo seu bem-estar próprio, de sua família ou comunidade, comportando-se como sujeito ativo do processo de promoção de sua saúde. Que ele possa compreender por que saúde é mais do que a "não doença", assim como outros aspectos relativos aos determinantes da saúde. O programa é produzido na forma de série temática composta por cinco programas de curta duração, "pílulas", com cerca de quatro minutos cada, e veiculado na rádio UFMG Educativa e em rede de rádios conveniadas do interior do estado de Minas Gerais, no Brasil. A programação também pode ser acessada em tempo real pela internet, na página www.medicina.ufmg.br/radio. Neste mesmo sítio é possível consultar as edições anteriores. Atualmente o programa é veiculado em 20 rádios, incluindo a rádio universitária (UFMG Educativa 104,5 FM). Uma das próximas ações a serem iniciadas brevemente é a busca e identificação de novas rádios interessadas em também veicular o programa, sem ônus para ambas as partes. Um importante divulgador deste trabalho se baseia na ação de transcrever as perguntas e respostas veiculadas no programa e publicá-las em dois jornais impressos locais: Super Notícia, tablóide com uma das maiores tiragens do Brasil, e Jornal O Tempo, distribuídos na região metropolitana de Belo Horizonte. Um problema tem sido a baixa participação espontânea do público na produção dos futuros programas.

195. A Study of Science News Reading Habits

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Abstract. Science communication generally refers to media aiming to talk about science with non-scientists. It is done by professional scientist but the role of mass media especially newspapers is very important in science communication. The science journalism has emerged an important dimension of journalism. There is no doubt that the knowledge of science subject of daily lives is very necessary for society. The wide application of science and technology has further necessitated us to know more and more about science subjects. The youths are most important group for the application of science technology and for adoption of scientific temperament in our daily lives. Their effort in the direction of gaining science knowledge is very important matter. Reading is one very important human activity as for as knowing or application/adoption of scientific information is concerned. Major portion of academic achievement is also related with reading exercise. We read not only for gaining scientific and other kinds of knowledge but also for entertainment, information and for other purposes. People read various kinds of publications for knowledge of science. Among them newspaper is one very popular media which play an important role in the dissemination of scientific information among common mass. Earlier Study reveals that more than 96 percent of newspaper reading is still done in the print editions, and the online share of the newspaper audience is only a bit more than 3 percent. Further, Newspaper reading habit is one very important aspect in popularizing science journalism .The reading habit decides a lot about how people take and think about scientific information. College students are important part of demographic segment who are expected to read daily newspapers and that newspaper publishers have sought for years to attract them to read daily newspapers. Importance of the study area-The study of reading habit is an important area of research in mass media. How are youth reading science news? The answer of this question can tell us many things. It helps to know the habit and behaviour of youth as for as the reading of news stories are concerned. This study may be very useful in improving the presentation of science news in newspapers. It can give idea to reporters about how to improve the quality of science news .It can also describe a lot about the present trend about how people specially youth take science communication. It can also reveal us how science news reading differs from general news reading habits.

Aims and objectives of the study– The main objective of the study is to know the reading habits and popularity of science news among the youths. It has tried to know in detail about how youths read and behave as for as science news is concerned. It has taken various aspects of science news reading in newspapers.

Methodology–This study has been done through survey method. A questionnaire has been prepared for it. It contains structured questions. This survey has been done among college going students of Kanpur city. A random sampling method has been done for the selection of unit and for the data collection. Data analysis conclusions and suggestions–The result has quantitatively and qualitatively been analyzed in detail. It has also been graphically presented. Important conclusions and suggestions have been given.

Keywords: Science news, Youth, Reading habits

196. Science Communication through Mass Media in Mother Tongue

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Abstract. Today, we are living in media society, according to agenda setting theory; the media is not only deciding the political issues in our society but also changing our life as well as behavior. The role of media becomes much widened in our day to day life. Now it is not only the 4th pillar of democracy but it in position of determining the pace of other pillars of democracy like Judiciary, executive and legislative also. Now a day, we can not imagine a society without any mass media. Mass media are deciding social ethics. With the opening of satellite communication mass communication & mass media has become inseparable part of Human life. Mass media becomes very important while communicating ideas intended to change behaviors of people right from developing awareness to adoption on of an innovation.

In India large majorities of the population is illiterate and hence have no scientific temperament. Moreover, more than 65 per cent of India population is living in villages, bound by traditions, deep rooted attitudes and superstition. This is a challenge for any science communicator. It is only through persuasive influence of mass communication, the illiterate and backward population in India can be directed towards any social change required for development of scientific temperament. Thus, mass media has important role to play in enlightening the masses to raise the standards of their living and improve quality of life with science & Technology.

The Indian media is under pressure of TRP. Due to this, Indian media is presenting only sensational, hyperbolic & false story. In these circumstances, unfortunately our media is not exploring scientific truth. Our society reflexes traditional values and sometimes it reacts as orthodox society. In this situation, scientific temperament is necessary in our society. So, we have to popularize Science. The main role of media is to inform and entertain the people, so we have to develop the interesting science fictions. Science have widened gap with art and literature. We have to fill this gap through creative writings of science & technology. Mass media is using new innovations of science and technology but under pressure of TRP and unethical practices, it is using to spread orthodox through mysterious programmes. The basic postulate to popularize the science is that, the science communication should be in mother tongue.

This is a small study about how scientific information and knowledge should given in mother language of any society .This study has been done in reference to Hindi language which is the third largest speaking language in the world. This study has adopted survey as well as observation method.

It gives very useful information about effective science communication in mother language irrespective of any language.

197. Science for Children: A Case Study in two Brazilian Newspapers

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Abstract. In Brazil, there are only a few media vehicles dedicated to science communication for chilfren. However, we believe that childhood is an approppriate time for laying a scientific foundation that will stay with these young readers throughout their intellectual lives. Even before they start going to school, children interact with natural phenomena and technology that incite their curiosity and their interest to know how the world works.

This study explores science coverage in the children's supplements of Brazil's two main newspapers for the elite classes, O Globo and Folha de S. Paulo. The corpus comprised texts containing science topics that were published in the two supplements (Globinho and Folhinha, respectively) during a one-year period (2008). Following analysis of these texts and their images, the editors and reporters assigned to the two supplements were interviewed about the processes involved in producing the material under study.

Findings suggest that although neither supplement specializes in science communication per se, they are both valuable vehicles for conveying information on science topics to a young audience. We identified 314 mentions of science topics (51.6% in Globinho and 48.4% in Folhinha). The mentions were classified by type of text: 30.9% consisted of news pieces; 14.3%, tips on upcoming exhibits or events related to science topics; 10.8%, tips on books or games related to the sciences; 10.5%, games and puzzles; the rest consisted of comics, short notes, letters and drawings by readers, short stories and poems, and tips on plays, movies, or television programs. The fields that received the most attention were the biological and human sciences, each accounting for 23.6% of the texts.

From our analysis of collected material and our conversations with the journalists at these two supplements, we saw that at both Globinho and Folhinha, writing about science and technology for a young audience is not considered synonymous with transmitting information in a childish or simplistic manner. To the contrary, it is important that the young reader at times feel challenged to understand topics and concepts that are new to him or her

Yet the supplements rarely inform their readers about the risks or controversies associated with science, something that might encourage a more in-depth debate about scientific research. We thus hold that science communication for the young public should respect children's ability to think and reach their own conclusions on science topics—even when these are controversial—so that young readers are encouraged to take part in their world, including the world of science, as well-informed citizens with the ability to make decisions. This implies that it is also important to make room to discuss controversial issues and the impact of science and technology on society, without overlooking a fundamental facet of science communication for children: the need to evoke their curiosity on topics of science and that which is happening around them.

198. Knowledge Investment in Agriculture through Mass Media Resources

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Abstract. In the current agricultural scenario, knowledge is a critical input with potential to enhance the system productivity manifold. The Indian Council of Agricultural Research (ICAR) continues to generate vast amount of user-friendly agricultural knowledge through its wide network of 98 research institutes and 578 KVKs across the country. Strong backward and forward linkages with farmers are essential for interactive communication to reap full potential of promising science and technology interventions. In an innovative approach mass media is being mobilized to act as an active partner for knowledge sharing and message multiplication. A National Agricultural Innovation Project (NAIP) funded project was launched with a view to utilize different modes of communication in an integrated manner for accelerated and sustainable delivery of messages. Mass awareness and diffusion of agricultural technologies at ground level is the overall goal. In a bid to improve and strengthen media relations, 16 media meets and interactions were held in different centers of the project across the country wherein more than 500 media persons from print and electronic media participated. This activity culminated into more than 1000 newspapers clipping in regional/national media. AIR and TV programmes are also being facilitated by the project teams in which subject matter experts share their experiences and directly interact with the farmers. Video films and audio capsules on success stories of agricultural technologies and innovations of farmers have been produced and ready for dissemination and telecast. Showcasing of ICAR technologies is an important activity of the project with ample opportunity to develop a direct interface with the technology users. So far 23 events have been arranged where more than 2,500 farmers/ entrepreneurs received first hand information on the technologies direct from the technology generators. Nine communication centers to interact with media are being developed as models in seven states spread from Sub- Himalayan region to coastal and central Indian covering agriculture, horticulture, livestock and other allied sectors. Capacity building of agricultural scientists is also a major activity to strengthen and enhance the communication skill, especially with mass media. Constraints, lessons and impact will be discussed.

Keywords: Knowledge dissemination, Mass media, Agricultural communication

199. Science Communication through Doordarshan With Special Reference to Doordarshan Kendra, Sikkim

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Abstract. There is a general lack of understanding of how advances in science and technology affect our lives. Against this background, controversial or sensational reporting on food safety, bird flu, global warming etc. can leave citizens confused and frightened and science misunderstood. This is why scientists are increasingly asked to communicate their work to a wider audience and science communicators and the media to act as the responsible bridge between the scientists and society.

To disseminate scientific information and to inculcate scientific temperament among the general mass we have been using print, audio and audiovisual media. If we concentrate on audio visual media, Doordarshan is playing a very significant role in the process of inspiring rural masses towards accepting social changes, establishing a constructive means for the upliftment of the common people and building a scientific temperament among the mass from its beginning. Though the history of Doordarshan in Sikkim is not very much old, but is giving a deliberate, planned and sustained effort to inculcate scientific temperament in the rural mass.

This paper is an attempt to analysis the programme content of Doordarshan Kendra, Sikkim as well as to find out various constrains in the process of science communication. The present work also emphasizes the assessment of the impact of the science programmes on target audience.

Keywords: Science communication, Broadcasting, Doordarshan Kendra of Sikkim

Introduction

'Development describes the growth of humans throughout the lifespan, from conception to death. The scientific study of human development seeks to understand and explain how and why people change throughout life'. Kendra Cherry

The influence of science on people's lives can be ignored at all. But a considerable measure of public mistrust of science and fear of technology exists in today society. The gap between science and common man needs to be bridged for which effective science communication is required.

Science communication is facing various problems as chatting capability, mass accessibility, cultural like-minded, linguistic and socio-cultural variety, socio-political obstacles, proper process of communicating science successfully and professionally and inculcating scientific temper among the people etc. But for the society developmenent, it is extremely necessary to bring a change in the attitude of the general mass from the non-scientific to the scientific one and to motivate them living in a scientific life. Science communication means to acquaint the masses with scientific knowledge for scientific awareness. All the arguments come to end when society mirrors a wide gap between scientific community and common mass, which needs to be shortened. To get rid of centuries age old misbelieves and superstitions and accomplish a familiar platform for science for mass, regional network and languages are very significant.

There are Print, Electronic and New Media. Each and every medium is very much significant in this regard if the due role is played. Among the all the modern media television is one of the most vibrant medium. Before coming the Disc culture, this medium was not so much accessible and was restricted within a certain strata of our society. The impact of audio visual media cannot be overlooked. It is not only attractive but also influential which is thought to be more viable to make common man grasped the scientific temperament beyond the age bar. For this reason science related information can be disseminated through this medium at ease to the common mass.

Significance of the Study

Science communication does not only mean to include the word 'science' as the contents. Talk 'about science' not 'on science' is a general tendency which should never be devoid of scientific contents. The very basic method of science communication means explaining common science 'how and why'. Nobody enjoys science unless it is linked with the linguistic stuff of cuts and curls, covered with surprising and genuine facts, and flavoured with piquant instance through cheerful presentation. So, there is awful necessity for dissemination of science sense among the common masses. But selection of the right medium, format, style and language for science communication is very important task considering background, sentiment, curiosity and amusement of the target audience.

It is true that TV is most acceptable medium in all stage in the country like India. There are many more Private Channels. But still Doordarshan has its own importance in common people's mind. In this research work we have taken DD Sikkim as case study. Because Sikkim is still unexplored in this context. There are 120 big and small newspapers, All India Radio and Doordarshan in Sikkim as the major media for communication. The attack of private audio visual channels still is not seen. Doordarshan is very popular channel out there especially in the rural areas. Though there are a few local cable television channels. Sikkim Doordarshan is trying its level best to inculcate scientific temperament among the common mass along with its all sort of constrains.

Objective

1. To analyze the impact of Television on general masses in communicating science.
2. To explain the role of Doordarshan in Sikkim
3. To study the various constrains faced by DD Sikkim in the field.
4. To assess the effectiveness of DD in this regard.

Research Methodology

The study is based on conceptual data. It is basically a case study. To collect the primary data, we followed interview & observation, case study method. For collecting the required information to complete the work we have contacted and taken help a few relevant sources. Keeping in view the complexities of social customs, cultural norms and values of the society, we specially have given stress on informal interview. For secondary sources we tried to explore a few web sources, Journals and books.

Discussion

The field work mirrors a few very important data. On that basis the discussion may be started. More than a generation ago, Marshall McLuhan predicted that television would bring us together into a "global village". Our world is more and more a single "information society", and television, as the world's most powerful medium of communication, is a key part of that society. Television can be a tremendous force for good. It can educate great numbers of people about the world around them.

The introduction of television was not an exception. The birth of the electronic television age is almost impossible to pinpoint exactly. Due to the numerous contributors that helped to develop this new medium, it is even more difficult to acknowledge any one person for its invention. The time span between the origin of the electronic television until its full understanding of how it functioned extends from the age of Thomas Edison (1847-1931) to the mind of Idaho farm boy, Philo Farnesworth (1906-1971).

Television in India, came in delay, after having the approval and consent of the government to a long awaited demand and needs of many Indians from different segments like scientists, educationists, politicians, businessmen and other institutions and professional study centres etc. With the financial assistance as acquired from UNESCO and equip mental support from U.S.A, the government of India started its Delhi centre on sept15, in the year 1957 successfully. If we consider the content of television, from the very beginning, along with other entertainment programmes, science is the un separated part of programme content in Indian television scenario.

The history of Science Communication through DD in India:

The use of broadcast and digital media had opened new vestal of science journalism. Doordarshan, the national television service of India, devoted to public service broadcasting is one of the largest television networks in the world. Since its inception in 1957, Doordarshan started telecasting science programmes for students. First popular science programme telecast was 'Vigyan Partrik' during 1971 to 1975 which was in 'B' and 'W'. In the year 1966 broadcast of agriculture based programmes had started. From 1982, 15 August colored television had started in India and brings a new ray in broadcasting. After that during 1984-92, a popular science programme named 'Quest' produced by Calcutta, ran for eight years. A programme on growth of science in India was produced by NCSTC named 'Bharat Ki Chap', 'Bigyan ki Baate',another programme that had broadcast in every satureday. Then 'Turning Point' was landmark programme on started in1991. It has been telecast in some regional languages also. Doordarshan also telecasts some western Television programmes. Many private TV channels such as National Geography, Animal Planet , Discovery etc are now-a-days taking up science programme seriously and after the emergence of these private channels , science and technology have become interesting for every people.

In North East Guwahti DD is the first centre.The history of Doordarshan Guwahati can be traced back to the year 1982. It was in this year that India hosted the 9th Asian Games and this event in New Delhi brought about a far-reaching change in the social and economic lives of people of Guwahati.

In the same year Doordarshan Kendra Guwahati was commissioned with LPT status on 19th November 1982. Later it was converted to HPT in the month of January 1985 with a transmitter power of 10KW covering range of 89-120 Kms. The Kendra transmits its programme through III/09 channel Band. At the initial stage, the Kendra was run in a rented House at Panbazar, Guwahati. Later it was shifted to its permanent area at R.G.Baruah Road Guwahati on 7th February 1992. The complex has got better facilities for recording and transmission with modern technology. It has got two colour studio set up. Besides, there is a studio for recording of North East programme separately (PPC, NE) and a computerized Earth Station for networking. Presently this Earth Station is utilized for Uplinking the Guwahati Doordarshan programme for networking to the entire country through INSAT-4B. programme. There was another achievement of DDK, Guwahati that the induction of External Satellite Service from 14th March 1995 whiles the North East News service begun to telecast from Guwahati from 1st March 1997 onwards. Moreover the other significant achievement of PPC (NE) was the installation of North-East Satellite Service (24 hours) with effect from 27th December 2000.

Being a public broadcaster Doordarshan always leads in production of programmes on mainly information, education and entertainment. Last year, DDK Guwahati telecast 31% informative, 24% educative and 45% entertainment programmes. Most of the content focuses science issues.

Doordarshan in Sikkim

Though completed in 2003, with 100-metre- tall tower in misty clouds the Gangtok DD centre still could not provide regular programmes like daily news bulletins catering to Sikkim. Doordarshan Kendra in Sikkim started telecasting programmes on regional language from the year 2003. Apart from these programmes in Nepali, the centre is a mere transmission point to relay feeds of national DD channels. Instead, the Gangtok centre airs only a half an hour round-up programme on Sikkim events three times every month and a 30-minute episode on agriculture in the state from Monday to Friday. In Sikkim, they mainly focuses on broadcasting programmes aimed for educating, entertaining and providing information to both the rural and urban masses of the state.

Programmes

There are basically two narrow cast programmes being telecasted from Sikkim currently.

1. Agriculture Episode
2. Sikkim Round-up

Agricutural programmes

Sikkim is an agricultural based state. So that is the reason Sikkim Doordarshan believes that this sector should be given a primary attention. Hence, the target audience for this programme is specially the agricultural labourers. This program mainly aims at the teaching the farmers regarding new technologies which would gradually increase their agricultural output.

Sikkim is under process of becoming an organic state the farmers are facing serious problems while practicing agriculture without the use of pesticides and chemical fertilizers. Here, D.D. is playing an active role in teaching the farmers regarding other various alternative ways of cultivation where these fertilizers and pesticides may not be used.

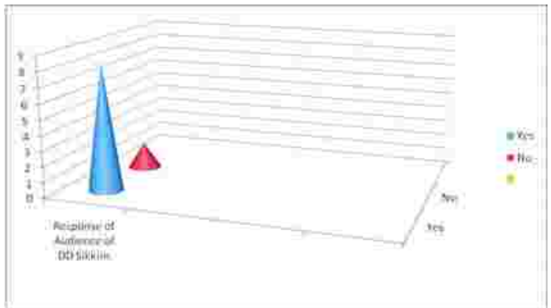
Through these programmes, it also attempts to inform the rural masses regarding various schemes of Central and State government, like National Rural Employment Guarantee scheme, Self help Group, Pradhan Mantri Gram Sadak Yojna for the upliftment of the poor and the tribals.

Sikim round-up

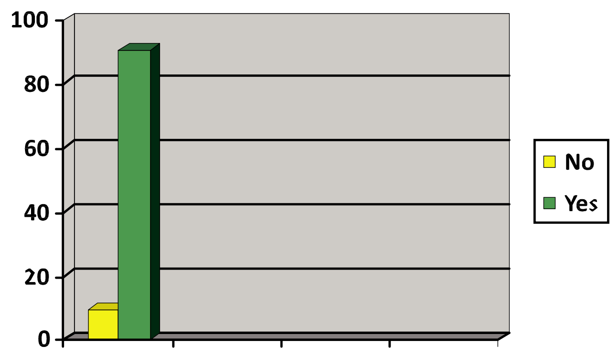
This programme basically informs the Sikkimese about the news and happenings within the State. It also covers various festivals, culture and tradition of the people living in Sikkim.

The Audience Feed Back

The audience prefers Doordarshan specially in rural areas. But they demand more programmes in their own language. The chart shows that 80.3 % watches DD Sikkim regularly.



The above chart shows that only 9.3 % target audience believe that Sikkim DD is able to inculcate scientific temperament properly in the society. The rest opined that it needs to give more time for the science related programme



Constrains faced by DD Sikkim

Though D.D. is a national network fully funded by the government, it facing lots of difficulties both mental and technical along with a stiff competition from other private players. A few problems are discussed here.

- Heavy rain and steep gradients also delays or cancels outdoor shootings.
- Landslides and road blockage due to heavy rainfall is a routine affair which affect the normal schedule of the transmission.
- Sometimes DD persons even have to work long distances for hours to reach the shooting spot.
- Unlike other private channel Doordarshan mainly focuses on broadcasting programmes focusing on education, information and not on entertainment..
- Less number of staff (especially trained in Science Programme).
- Inadequate infrastructure.
- Lack of common awareness.

Conclusion

There are 31 regular employees at the centre and around estimated 2 crore is annually spent on the salaries and the maintenance cost in Sikkim DD. There it is strictly followed the code of ethics of broadcasting due to which it cannot sensationalize issues like other private channels. Its real motive/objective is not profit or to raise the T.R.P. but to work for the people towards the path of development and nation building. Sikkim DD has its own production team and aims to supply the people with more educative, informative programmes and scientific awareness inculcating is one of them. The D.D Kendra is looking forward to extend its regional programmes. Television spreads information in an accessible format to viewers quite quickly. When an important event occurs, the audio and visual proceedings of that event can be broadcast in order to inform viewers of the event. Practically this centre needs special attention of the Government. More trained staff with required infrastructure may solve the various problems because the target audience is there to get the information.

Acknowledgement

Mrs. Champa Bhowmik, the Production Executive of the D.D. Kendra Sikkim, Students of Journalism and Mass Communication, Sikkim University.

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200. Scientific Communication Practices for Sustainable Development: A Participatory Approach

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Abstract. In this research paper, an attempt has been made to identify and delineate the role of participatory communication science in general and specific roles of various communication channels in meeting the goals of sustainable development in particular. In case of specificity, the manner in which science communication plays its role for sustainable development is discussed in detail . Sustainable development is an integrated and holistic approach that calls for the participation of individuals, groups, organizations(particularly the NGO's),public and governments at local, regional, national and global levels. The goal of sustainable development is not confined to one locality or region or nation but embraces the entire globe. It extends not for a few years, but for the distant future too. Thus spatially or temporally its scope is very wide. It requires people to think globally and act locally for the development and growth of rural sectors.

Informed and conscious citizens can utilize poverty alleviation programmes effectively and successfully. Informed and conscious citizens can also play a responsible role in promoting environmental protection in various walks of their lives.. In fact to fulfill the goals of sustainable development there is an indispensable need to mould a lifestyle that is environment friendly and equitable all over the world.

Communication Science in general and various communication channels in particular have a potential role to play in moulding such a lifestyle. Poverty eradication, protecting the environment, reducing the consumption of non-renewable resources and increasing the use of renewable resources, conservation of biological diversity, land degradation and deforestation, waste management, using appropriate technologies, land reforms, population control and stabilization, upholding basic human rights, social welfare and women's upliftment, promoting intra-generational and inter-generational equity, and participation of people from individual, local levels to global levels, being the various important objectives of sustainable development, different communication channels have a potential role to play in fulfilling these objectives. Though communication alone is not sufficient to meet these objectives, it is a crucial element in facilitating the fulfillment of these objectives.

Introduction

The concept of sustainable development has occupied a central place in every aspect of human life today. It is a multidimensional and multidisciplinary concept covering almost all spheres of human activity. Sustainable development has become the concern of economists, ecologists, administrators, lawyers, communication exports, environmentalists, human right activists, feminists, scientists and NGO's. In other words, it has become everybody's cup of tea. Since the present study aims at studying the role of communication in sustainable development without identifying the various implications of the concept, therefore, an attempt has been made in this research paper to discuss the various implications of sustainable development.

The world commission on environment and Development (WCED,1987) defined sustainable development as the 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' It is observed that sustainable development is a coin which consists of two obligations on its two sides. One side is the alleviation of poverty and the other, the protection of environment. Sustainable development is very much linked with the involvement and active participation of people. It is a holistic concept that can be on the global, national, local and individual scale. Communication is an intervening variable without which the materialization of different goals of sustainable development is not possible. Therefore. Communication has the key role in facilitating the participation of people relating to sustainable development.

Conceptual Framework

The present study has been taken up with the following theoretical framework. There are a myriad of theories and models of communication, but there are only a few theories and models which deal with the questions of development. Therefore it is useful to discuss the relevant models and theories in the context of the present study as follows.

Development media theory deals with the task of media in developing countries. It emphasizes the positive uses of the media in national development and for the autonomy and society. To a certain extent elements of this theory favour democratic and grassroots involvement, thus promoting participative communication models (Mcquail,1987). The one thing of the media is the acceptance of economic development itself and often the correlated nation building, as an overriding objective. To this end, certain freedom of the media and of journalists is subordinated to their responsibility of helping in this purpose. Collective ends rather than individual freedoms are emphasized. With the failure of the Dominant Paradigm of development , and its communication approach in bringing about the expected change, there took place a thinking about the alternative paradigm of development which led to the emergence of the concept of another development and subsequently a more specific one, sustainable development. With regard to communication also, a major shifts has taken place from top-down authoritative model of communication to a two way horizontal and participatory model of communication.

Significance of this research Study

There have been many studies carried out on development and communication, media and development, environment and media, environment and communication and communication, rural development and communication media, traditional folk media and development and participatory development communication. But, though sustainable development is the latest and present trend of development, so far, proper attention has not been paid to this area from communication point of view. Therefore, it has been felt worthwhile to study the role of communication for sustainable rural development.

Research Questions

Sustainable development being the latest and the present trend of development, the broad aim of the study is to analyze the role of communication in sustainable development and to recommend a communication strategy for sustainable development.

Objectives of this study

a. To identify the implications of sustainable development.
b. To find out the policies and programs of Indian Government towards sustainable development.
c. To study and analyze the role of communication science in sustainable development. An empirical study has been carried out in a backward and environmentally affected district in Orissa.

The following aspects were sought to be examined in Koraput , Orissa.

a. Role of Communication in the success or failure of poverty alleviation programs.
b. Awareness about environment, Family Planning and reflection of that awareness in their lifestyles.
c. Source of information to people and their media habits.
d. Role played by various communication media in relation to combating pollution and in connection with environmental movements.
e. To recommend a communication strategy for sustainable development.

Role of Communication for Sustainable Development

Communication is a basic instinct of man. It is the fact of life of not only human beings, but also of animals, birds and other living beings. Communication maintains And animates life. It is also the expression of social activity and civilization. It leads people from instincts to inspiration through various processes and systems of enquiry, command and control. Communication integrates knowledge, organizations and power and runs a thread linking the earliest memory of man to his noblest aspiration through constant thriving for a better life. As the world has advanced, the task of communication has become ever more complex and subtle to liberate mankind from want, oppression and four and to write it in community and communion, solidarity and understanding. Mass communication comprise the institutions and technology by which specialized groups employ technological devices(press, radio, films etc.) to disseminate symbolic content to large, heterogeneous and widely dispersed audiences.

Poverty eradication, protecting the environment, reducing the consumption of non-renewable resources and increasing the use of renewable resources, conservation of biological diversity, controlling various types of pollution, land degradation and deforestation , waste management using appropriate technologies land reforms, population control and stabilization, upholding basic human rights, social welfare and woman's upliftment, promoting intra- generational and intergenerational equity and participation of people from individual, local levels to global level, being the various important objectives of sustainable development , different communication channels have a potential role to play in fulfilling these objectives. Though communication alone is not sufficient to meet these objectives, it is a crucial element in facilitating the fulfillment of these objectives.

Communication policy and Strategy

Strategies that include communication for sustainable rural development as a significant aspect of agricultural and rural development are sorely needed. Efforts in this direction are being made, but governments have yet to recognize fully the potential of this factor in promoting public awareness and information on agricultural innovations, as well as on the planning and development of small business, not to mention employment opportunities and basic news about health, education and other factors of concern to rural populations, particularly those seeking to improve their livelihoods and thereby enhance the quality of their lives.

Rural development is often discussed together with agricultural development and agricultural extension. In fact "agricultural extension" is often termed "rural extension" in the literature. In contrast, rural development includes but nonetheless expands beyond the confines of agriculture, and furthermore requires and also involves developments other than agriculture. Accordingly, government should consider the establishment of a communication policy that while supporting agricultural extension for rural development also assumes the role of a "rural extension" service aimed as well at diffusing non-agricultural information and advice to people in rural areas.

A communication policy would aim to systematically promote rural communication activities, especially interactive radio but also other successful media such as tape recorder and video instructional programs. Computers and the Internet may not yet be accessible to rural communities but they serve the communication intermediaries and agricultural extension agents who provide information to rural populations. Other devices such as cell phones hold considerable promise for the transfer and exchange of practical information.

For reaching the final agricultural and basic needs information users in rural areas today, radio is the most powerful and cost-effective medium. However, other traditional and modern communication methods are equally valuable, depending on the situation and availability, like face-to-face exchanges (via demonstration and village meetings); one-way print media (such as, newspapers, newsletters, magazines, journals, posters); one-way telecommunication media (including non-interactive radio, television, satellite, computer, cassette, video and loud-speakers mounted on cars); and two-way media: (telephone, including teleconferencing, and interactive (Internet) computer).

Information and communication technologies (ICTs) have proved to be important for Internet users and for the intermediate users who work with the poor. Pilot experiences show that various media are valuable for assisting agricultural producers with information and advice as to agricultural innovations, market prices, pest infestations and weather alerts.

ICTs also serve non-farming rural people with information and advice regarding business opportunities relating to food processing, wholesale outlets and other income-generating opportunities. In the case of non-agricultural rural development interests, a communication for rural development policy would aim to promote diffusion of information about non-agricultural micro-enterprise development, small business planning, nutrition, health and generally serve to provide useful, other-than-agriculture information.

By its very nature as mass media, communication for rural development can provide information useful to all segments of rural populations. However, it would serve as a first effort toward advancement of "rural extension" services and activities aimed at rural development concerns beyond those of agriculture. Thus, extension and communication activities would be expected to work in tandem, allied in the common cause of supporting income- generating activities, both agricultural and non-agricultural.

Concluding Remarks

The discussion mentioned above shows that though there are many definitions and multiple dimensions to sustainable development, these definitions and dimensions are not contradictory to each other but they corroborate each other. Broadly, the sustainable development can be described as the poverty alleviation i.e. to enable the present generations to meet their needs and environmental protection to enable the future generations to meet their needs. In relation to communication , it implies that communication in general and various communication channels in particular have a vital role to play in creating awareness about the various poverty alleviation programs initiated by the government; in the problem articulated by poor, and thus, in bridging the gap between the planner and the beneficiary. Environmental protection and promotion and population control being the other broad dimensions of sustainable development, various communication channels have a responsible role to play in informing, educating and conscientizing the people about various environmental issues and promotional program and sustainable use of natural resources, using renewable sources of energy, conservation of biological diversity, waste management, prevention and control of pollution, family planning, etc. Besides, communication is of vital importance in promoting human rights, gender equality, social welfare and peace. Since the sustainable development calls for the participation of people– individuals, national and international levels, various communication channels are of great importance in facilitating the participation of people from individual, local levels to global level. Besides, since sustainable development calls for a lifestyle that is equitable and environment-friendly in moulding such lifestyle throughout the globe, communication has a potential role to play.

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201. What's so Exciting about PCST?

Prakash Khanal

Abstract. Science writing and science communication still continue to cast its spell on me. For, I believe that the general public in the developing world stand to benefit much more from the powers of this devil that we know as science and technology. But for that, we, the science communicators have to be efficient and effective as well as dedicated. It is up to us, the science communicators, to make the miracles of science available to those who could make use of it. Or, make them aware of its misuse as well. There is a dire need to critically appraise the way we communicate science, why and for whom we communicate science? On the one hand, we cover complicated scientific developments, while on the other we fail to hire a full time science journalist writing about the day to day science affecting the common man. These are extreme scenarios but true. Why is it that the science journalists have difficulty surviving as one in our countries? Why in Nepal there is not a single dedicated full time science communicator in any media? Who is to blame for this lack of interest in science communication? Have we failed to highlight the importance of science information sufficiently enough in the past 12 years that we have been meeting in the name of PCST? Has our writing lost the power to influence and motivate? The answer may be that the developing nations should pioneer their own model of science communication rather than blindly following the Western models which continues to become more academic. The challenge is to make science information general public oriented for it is this reason we started to talk about Public Communication of Science and Technology or PCST in the first place!

202. Communication Errors in Transferring Scientific Information from English to Hindi

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Abstract. In a country like India where different languages are spoken, it becomes necessary to make the standard text available in regional languages or at least in the national language i.e., Hindi. For this translation from English to Hindi is required. Translation is referred to as a process to transfer information from a source language to a target language. It is well versed that it is influenced by cultures, society, policies, etc. and in this way translation is another means of communication. Scientific translation is a specialty within this area that must be also considered from the point of view of science communication. Translators have to take important decisions when translating scientific texts, such as the selection of words that scientists, journalists, teachers or other science communicators will use in their daily activity, the use of phrases that belong to the common target language, the translation from a culture to another.

When newspapers publish science news, they usually use as sources press releases, news from agencies, and sometimes a secondary source. When it comes to publish the news in Hindi newspapers, the original information in English can suffer some modifications during the translation process. They may eventually lead to conceptual errors. The present study aims at an analysis of such errors in articles in newspapers and their possible implications to the society.

203. Science Communication & Media in India in the 21st Century

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Abstract. If you are a layman, scientist, educationist or a media person, you may have observed that over the last few years there is a fast emerging trend where old communication methods are being rapidly replaced by a wider inquiry and dispensation based digital process. This shift in trend or attitude is definitely slightly upsetting for media persons who may have grown up under the earlier authoritative school of thought, where the reporter was placed at the centre of the fact dispensing process. This is particularly true for India where modern science communication methods continue to show great scope for improvement, despite recent advances and innovations.

In the present system, communicators have to write about science topics to encourage interest and learning in the average reader. There is more responsibility placed on the communicator to 'learn' for himself, as he uses his skills to effectively dispense knowledge. For effective science communication, there are a wide variety of methods that are possible before the average person. These methods include the time honoured traditional print media now largely propped up with the digital media. Perhaps more widespread in both the urban and rural scenario is the use of the print media chiefly making its presence felt in the form of books, pamphlets, newspapers and magazines to name a few. Emphasis on the type of each method varies from place to place in their implementation and efficacy.

There can be no doubt however, that in years to come, the role of computers, digital media, electronic publishing and the Internet in science communication, cannot be underestimated. The ease of communication and the comparative easy availability of recent, relevant knowledge from all over the world definitely make these communication methods a winner. The present paper deals with a spectrum of 21st century media methods; applied aspects for the future of science communication in India, their relevance in the global scenario, with emphasis on the use of computers, electronic publishing and the internet to serve mankind better.

Keywords: Science communication, Media person, Effective, Innovations, Computers, Internet, India, 21st century

204. Media and Science Communication Creating Science Opinion Leaders—A Case Study of Science News Magazine

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Abstract. Media play an important role in science communication by bringing scientists/experts together with the public, involving scientists/experts in transferring science information in an easily-undertook way, and thus engage people's daily life with science. This paper uses Paul F Lazarsfeld's Two-Step Flow Theory to analyze Science News Biweekly's efforts in science communication, including composing the science communication column and organizing activities like online training course for science journalists, seminars including various participants and discussing science's role in policymaking of public health, GM food, and urban planning, and science-media exchange programs involving scientists and journalists. By all these activities, Science News Biweekly first tries to train scientists/ experts and journalists into opinion leaders who are both good at science knowledge and communication, and then create opportunities for them to radiate their effects to the common people in a way widely engage the public. The analysis finds that because the second step, that is the interpersonal communication, is thought to be more important in convincing people to believe a certain scientific information and thus influence decision-making, media can actually try to do more to "mould" opinion leaders and improve people's perception of science knowledge in the first step. And in the field of science and technology, opinion leaders' role in the government's policymaking is much more significant. Thus media should try more to "train" more opinion leaders, so as to promote science communication effectively.

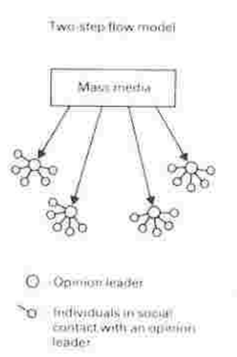
Keywords: Science communication, Opinion leaders

Introduction

Media play an important role in science communication by bringing scientists/experts together with the public, involving scientists/experts in transferring science information in an easily-undertook way, and thus engage people's daily life with science. However, Chinese scientists were tending to be reluctant to do science communication. In two surveys done by Science News Magazine, about public health communication and GM food safety communication respectively, 56% and 63% participants thought that scientists haven't done enough in science communication (Tan & Jia: 2010a, Tan & Jia: 2010b).

The fact that scientists' efforts to communicate their researches have been decreasing, was partly due to the ignorance of importance of communication and partly due to the lack of ability to do dialogues with the public.

Besides, more than 50% science journalists thought that it was hard to receive help and cooperation from scientists. Scientists' reluctance to do science communication and popularization has become one of the reasons why there was so much misreporting of topics related sciences. This directly leads to the lack of opinion leaders in the field of Science, especially about controversial topics like GM food and TB vaccine. Without accurate information from opinion leaders, interpersonal communication among the public tends to be in chaos.



Source: Katz & Lazarsfeld (1955)

According to Paul F Lazarsfeld's Two-Step Flow Theory, information from the media moves in two distinct stages (Katz & Lazarsfeld: 1955). First, individuals (opinion leaders) who pay close attention to the mass media and its messages receive the information. Opinion leaders pass on their own interpretation in addition to the actual media content. Opinion leaders are quite influential in getting people to change their attitudes and behaviors and are quite similar to those they influence. So it is of great influence and importance to "mould" influential opinion leaders in the field of science, who can transfer accurate scientific information to the public and avoid personal dissemination of pseudoscience.

Analysis: Case Study of Science News Magazine

Science News Magazine, operated under the Chinese Academy of Sciences (CAS), is the first and only professional news magazine targeting the science community in China. It aims at serving for scientists and promoting the development of China's science. Its readers include policymakers like health minister Chen Zhu, science minister Wan Gang as well as all academic leaders and chief scientists from CAS and CAE (Chinese Academy of Engineering), NSFC (National Natural Science Foundation of China). With widest readership in China's science community, Science News Magazine has the base to choose science opinion leaders. And a professional medium, it has the platform to provide dialogue between science opinions leaders and the public.

Also, in partnership with British Embassy, China Science Reporting Network and the World Federation of Science Journalists, as well as China Association for Science and Technology (CAST), Science News Magazine has done a lot for advancing development of science communication in China and engaging scientists to transfer their professional knowledge to the public. Sponsored by British Embassy, Science News Magazine designed and organized the Science into Policymaking Series Seminars, discussing scientific evidences' role in policymaking of controversial topics like public health, GM food safety, waste incineration, and urban relocation. During discussion of such controversial topics, certain scientists were promoted to be opinion leaders and radiate accurate information to the public.

For example, Zhu Zheng from the Institute of Genetics and Development Biology of the Chinese Academy of Sciences, successfully become a typical opinion leader in the field of GM food safety after he acted as a leader in a hastily arranged session derived on the "Communication and Dialogue of Agribiotech Symposium". During this symposium, members of the general public berated and quizzed scientists on concerns ranging from the legitimate to the bizarre. A group of protestors descended on there, prompting organizers to set up a side session between members of the general public and scientists.

A group of experts, leading by Zhu Zheng, reassure the audience and answer their questions patiently. As a result, those encounter yielded great consensus and the protestors appreciated the chance to try to set the record straight. This hastily arranged session was praised as "a milestone" in the history of GM food safety communication. This shows that science communicator can and should try to provide accurate information and play a role as a bridge between scientists and the public, enhancing scientific communication and promote the right understanding of science issues among the public.

In addition, Science News Magazine held many other activities like Seeking Future Star of Sciences, Scientist-Media Role Exchange Programme, and so on. For the Scientist-Media Role Exhange Programme, young scientists were encouraged to work as intern journalists in media while science journalists were encouraged to work in science institutes as public information officers and public engagement campaign assistants. This prohramme not only created greater mutual understanding between journalists and scientists, but also increased the communication skills of professional and reporting capacity of journalists. Both science opinions leaders and journalism opinion leaders were created for more effective and efficient science communication.

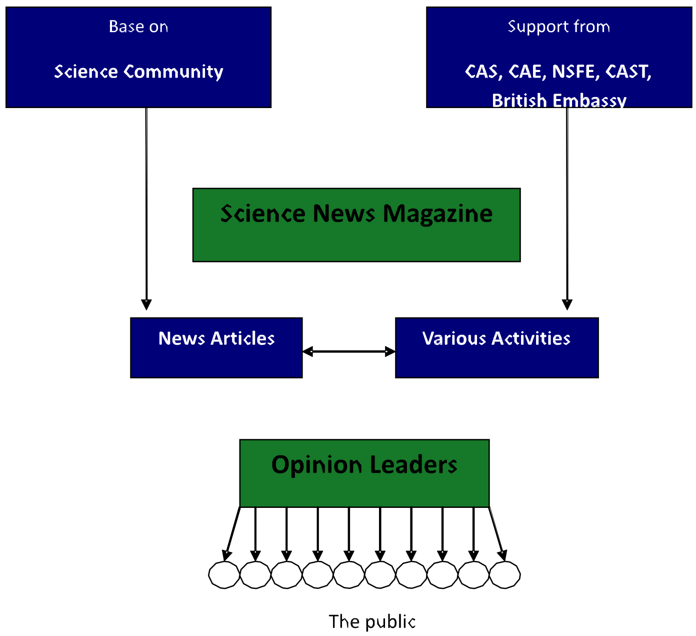
By all these activities, various opinion leaders in various fields were chosen and moulded. What's more, owning various media resources, including blogs, websites, television, broadcast, newspaper and magazine, Science News Magazine has multiple channels to publicize its activities, increasing popularity and fame for all these opinion leaders and making them as influential as possible.

So far, Science News Magazine has planned a series influential scientific evidence based reporting like the truth of anti-dam, questions against earthquake prediction and GM food safety (Zhao: 2009). All those news reporting, together with various activities well schemed by Science News Magazine, promoted and branded many well-known opinion leaders, greatly facilitate science communication in China, improve the process of policymaking and increase Chinese people's scientific literacy. Of course, in the way to more effective and influential science communication, Science News Magazine also faces many challenges. One thing is that to organize all those kinds of activities, it needs more funding and financial support from various organizations which truly intend to enhance science communication.

Another thing is that market-oriented media reform in China has led to exaggerating reporting, entertainment, and unserious journalism. To truly promote science communication, Science News Magazine has to maintain a top-notch journalist and operation team, to ensure highly qualified evidence-based reporting and effective communication activities.

Conclusion

From what is analyzed above, Science New Magazine has formed a mature system for influential and effective science communication. As showed by the graph below, Science New Magazine is based on and targeting at the science community, so it owns abundant recourses of scientists. With backup of such recourses and support from organizations like CAS, CAE, NSFC, CAST and British Embassy, it is able to organize various activities to cultivate opinions leaders, who will be further consolidated by media reports of itself and its counterparts. Such route which focuses on the first stage of communication, that is process of making opinion leaders by media, has been proved to be valid and feasible.



Communication Model for Science News Magazine

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205. Science Museums as a Communication Means in India: A Case Study

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Abstract. A science museum is a means to communicate science to the public. It is a museum devoted primarily to science. A public facility is much like a museum but with exhibits, often interactive in nature, that demonstrate various scientific facts. In India, there are about 50 science museums located in different cities. Some science museums are also assisted by mobile vans which are road transport vehicles equipped with computing and communications infrastructure. It is an innovative form of providing training and information.

The aim of the present study is to analyze the effectiveness of science communication through museums and exhibition in India with emphasis to rural areas. In our present work, we have conducted a survey of a sample of rural population about their exposure to science museums and exhibitions. The study revealed both positive and negative aspects of the present network. The detailed outcomes will be presented along with suggestions for betterment.

206. Gender Attitudes and Health: Communicating Health Among Young Girls using Channels of Mass Communication

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Abstract. Bangalore is popularly known as the silicon valley of India. While one group of people appears to be enjoying the benefits suitable for the first world the other group appear to be living in the fourth world. Though the demarcation exists in all facets of life style, the difference is rather distinct with issues related to health particularly that of a girl child. Media which should be playing a pivotal role in bringing in the change through its popular genres of programs appeared to have failed miserably in bringing the change in gender attitudes and health issues. Hence the study was undertaken. This study tries to explore different channels of communication to complete the effective process of communication on issues related to health. Data will be obtained from respondents belonging to both urban and rural part of the Bangalore City. The target respondents will belong to the age group of 12 to 19 years. The study tries to explore the possible association between gender-role attitudes and health communication using KAP theory.

207. The Role of the Internet in Science Communication–Case Study of China's Network Science Communication

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Abstract. Internet, due to the spread of the unique strengths and strong communication ability, is more prominent in mass media. This article discusses the innovation of Internet applications to science communication from dissemination process, takes an example of China to explore the Internet's role in science communication, and introduces several modes in China Digital Science and Technology Museum. The article thinks that internet as a new media, not only has a new features and modes in science communication, but also has a profound impact in promoting dialogue on the whole society.

Keywords: Internet, Science communication, SNS, Blog

Introduction

The "26th China Internet Development Status Survey Report", released by the China Internet Network Information Center (CNNIC) on July 15, 2010, shows that, as of the end of June 2010, China's netizens reached 420 million! Internet has played an active role in users' access to information and community involvement.

Mass media is a major route of science communication, Internet, due to the spread of the unique strengths and strong communication ability, is more prominent in mass media. Since WEB2.0 era, the network communication patterns break through the one-way-to-many communication model, and form a "two-way, no center " communication mode. Everyone is not only a communicator but also a communication object, and changes their role during interaction with other people. Thus the main body of science communication through internet is not only educational institutions or educators, but every Internet users. It is no longer a top-down one-way communication, but the cross-connect communication. These make the Internet play an increasingly important role in science communication.

The Main Internet Application Mode Suitable for Science Communication

SNS and 3D virtual community

SNS (social network serve) social networking service is a platform-style people-centered services, encourage people to build internet-based network of social contacts, achieve real social network mapping and create a virtual network social system. There are a lot of SNS-based services, including forums and personal room.

3D virtual community is actually a service platform using 3D technology. It bases on community, through role-playing, 3D models, etc. and creates a closer with the real world context, and brings a stronger sense of immersion to the public. "Second Life" is the most well-known 3D virtual world, the Exploratorium in the San Francisco has stationed in it to promote scientific communication.

The most common characteristics of these two forms is platform and social service. Users will gradually form a similar relationship network in the real world through platform activities, so that the transfer of information are faster and more accurate, services are more in line with demand.

Blog and micro blog

Blog is actually a public online diary, with a strong personal color. It provides a form of communication with a number of Internet users through attention, message and comment. If someone's blog brought together many of the readers, the impact of his remarks is very high. Therefore, the S&T spread through the blog, can attract a lot of users to pay more attention to S&T with the personal impact of bloggers, on the other hand it enhance the credibility of the information and science education effect because of their professional background.

Micro blog pay more attention to the rapid dissemination of information, moreover micro blog is also associated with the mobile phone, and so the public can use the phone to record what they saw, heard and thought at any time. Then they issued to their audiences' phones by Micro Blog in the most refined vocabulary or pictures. Of course it will also appear in the Micro-Blog's personal home page, through the spread of the Internet it enlarge the communication range.

Wiki

Wikipedia is a collaborative writing tool for people. Wiki sites depend on many internet users' maintenance; everyone can create, correct, and add what he is interested in, even co-author a novel on Wiki sites. Therefore this form can mobilize the collective intelligence of the majority of Internet users to create and interact, so that science communication and social dialogue are more extensive.

The Innovation of Internet Applications to Science Communication

H•Lasswell, American media scholar, proposed communication "5W" mode in the "The structure and function of communication ". That is, who, says what, in which channel, to whom, and with what effect. The following will analyze the innovation of Internet applications to science communication mode from 5 basic elements of the process of transmission.

Communicators and communication objectives doesn't have a clear distinction, and form a no-center mode

Traditional science communication in general, experts or agencies of science communication play a role of communicators, the public are objects and only receive passively information, can not participate in the production of information, such as newspapers or magazines. But on network, the public can not only receive information, but also timely feedback information, even take the initiative to release information. So it is a interactive two-way dissemination. It broke the one-way communication mode, communicators and communication objects tend to unity, thus forming a no-center mode of communication.

The contents are richer and shows "Fragmentation" trends

Internet encourages public participation in the discussion and resolution, anyone can express their own views on any event or information, and therefore it enriches information, knowledge production and organization, and creates a huge source of information. The form changes from the text to multimedia and 3D virtual simulation and other forms. In addition, the development of mobile Internet technology and micro-blog application, communication content have a feature of the "fragmentation", not only in the information content is more streamlined and trivial, but also to make information more numerous and rich, even led to the differentiation of the audience to form a separate group communication pattern.

From the channel, the Internet makes people connection to the true sense of the exchanges, not just dissemination, and close to life

Internet is called the "fourth medium" following the press, radio and television. It not only has their general characteristics, but also unique advantages of digital, multimedia, real-time, interactive delivery. It also has spread fast, wide range, high-impact features; the feedback mechanism is timelier. In addition, SNS-based communities encourage the public to build their own space, and the original information space turn into private space and public space, so that the channel further stratified, information further focused and enhance the media and people close degree to production and life .

From the spread effect, the highlight of the public discourse and value, and the influence and credibility of ***information***

On the one hand Internet broke through the barrier of time and space to make more convenient transmission of information, and communication range and influence are greatly enhanced. On the other hand, it gives each of the public equal right to speak, the public can show their knowledge and express their views, thus enhance their personal values and sense of honor, make information more easily spread. Because people participates the production and dissemination of information, it avoids preaching, and through sharing, discussion and other forms of equal exchange, enhance the credibility of information.

Take the example of China to Study Internet's Role in Science Communication

In China, science communication through the network is played more and more attention on. According to "Popular Science Infrastructure Development Report of China" (2009) show that, to the end of March 2009 popular science network facilities in China has reached 601. These facilities refer to the popular science education web site or science sections in other sites in which Internet as a platform.

The popular science infrastructure plays a unique role. According to survey of Tsinghua University media research lab, Internet is the main channel in the public access to earthquake rescue and relief information. 36% of the respondents acquired knowledge about earthquakes from the network media, 34% from television, and 20% from newspapers. It can be seen from this data, internet has become an important channel for the public to understand scientific knowledge.

Rely on the collective wisdom to disseminate science

Internet's largest feature is to take full advantages of the wisdom of the majority of Internet users, either SNS or WIKI and so on, and show up contribution and creation of ordinary people, so that science communication has more participation of civilians, and is easy to accept.

There is a site named "Yeeyan", which brings together many of the volunteers with foreign language translation capabilities. After the earthquake in Sichuan, the site immediately launched a series of translation-based activities about disaster self-help and psychological counseling. The activities attract a large number of volunteers, who finished several foreign books' translation in accordance with procedures of professional translation in a very short period of time, such as "Earthquake Search and Rescue Manual" ,"psychological first aid". These works played a significant role in the earthquake.

In addition, China has many WIKI service providers, such as hudong.com, IT encyclopedia and so on. These sites make full use of collective wisdom of Internet users to explain many scientific terms, and some professional service providers gathered a large number of experts in various fields, and establish an expert-centric service platform to enhance knowledge management effectiveness.

Rely on the speed and coverage of internet, to spread S&T quickly

Compared with other media, the Internet has greater timeliness. The production and dissemination of information on network are very quickly, while Internet can be found in any place, and so there is a strong advantage in the dissemination space. The communication speed of Mobile is faster, and the form is newer. It brought unprecedented changes on science communication.

May 12, 2008, the devastating earthquake in Sichuan occurred. 12th at 18:00, People's daily online launched the first mobile news of "Earthquake Relief". On 15 evening, 22 million mobile phone users received mobile news. CCTV mobile TV network released 1115 news in 7 days, with more than 15 million visits and 3.5 follow-ups.

June 25, 2010, County of Malone Qujing City YunNan province suffered heavy rainfall. At noon June 26, Qujing Publicity Department began to broadcast the disaster and relief situation through Micro-Blog. Messages updated rapidly and timely, and conveyed the information of the disaster, placement of victims to Internet users in the first time. "Micro-blogging Qujing" also won the majority of internet users' concern and became the first-hand source of information.

"Flooding, power outages, almost a building of people gathered in the candle." At 3:23 on August 8, 2010, this micro blog was the first message from the debris flow areas in Zhouqu Gansu province. 8:57 am, the first photo of Zhouqu disaster was released by this micro blogger who named Kayne, and quickly led to the concern of users. In just an hour this picture was forwarded thousands of times. Then, Kayne has sent nearly 200 graphic about the first scene, including the bloody quagmire, the rescue soldiers ... ... many of the media in the subsequent reports used these pictures.

The role of science blog in science communication become more and more apparent

Civic scientific literacy in China is not very high, and there are still inadequate in the transmission of information about science. Many experts and technical personnel, graduate students take full advantage of blog to create a science blog circle. These bloggers have good educational background and knowledge structure, and strong sense of mission; they described various S&T events user-friendly and guided public opinion, which has played a unique role in the field of science communication.

In China, blog in Sciencenet.cn and Songshuhui.net are very famous. Blog in Sciencenet.cn is a platform of the exchange of scientific knowledge, scientific spirit, cultural, scientific methods, and to show themselves. According to a survey conducted by the end of 2008, 50.6% of bloggers have the title of professor, and 30.1% are associate professors. Because of their identities, the credibility of information they disseminated greatly enhanced. In the science communication of "H1N1 influenza", bloggers wrote a lot of popular science blog on influenza. According to the development of the epidemic, they Interpreted and inferred the pathological reasons depending on their expertise

, sponsored discussions on popular issues and provided the precautionary approach and so on. In addition, they also translated the latest influenza information and knowledge to expand the public's view. From April 25, 2009 to June 21, they issued 147 blog about "H1N1 influenza", which nearly 60% written by themselves, over 10% translated. This blog circle truly became the important scientific information dissemination media. The role of the blog is also reflected through the thread, message, and comment which make the two sides interact,

and message and feedback more convenient. Bloggers with their own experience and knowledge, communicate with people who are uncertainty and confusion to the scientific issues, so that the incident itself and the solution become clearer. From the science communication, the information tends to more complete and comprehensive, and has better education effect.

China Digital Science and Technology Museum (CDSTM) and its planning

CDSTM is a national science communication Internet platform, which aims to promote public learning knowledge, discussing scientific issues, expressing insights. CDST has been attached great importance to scientific and technical communication with practical things. This year China launched the "Chang'E II" Satellite, CDSTM conducted some follow-up reports and integrated a number of interactive resources to promote public understanding of aerospace knowledge. Since September 28 to October 7, 10 days, a total of 1.49 million people visited the resources of CDSTM, access to more than 5.36 million pages, click rate of 22.78 million.

We are now planning to change the vision, and we will integrate activities, games, community, blog, 3D interaction, mobile networks, GIS and many other applications, to build a science communication and service platform, which focus on S&T and promote social dialogue. Three main applications used in CDSTM are following:

Science SNS: Take full advantage of the features of SNS, and create a virtual community where the public can discuss science. In addition, we will give full play the leading role of science communication institutions to build CDSTM as a network habitat of volunteers, as an area for volunteers to plan and join community science activities. Such as the forum, experts will initiate topics and lead people to discuss. This will help to promote social dialogues between the government and the public, scientists and the public, and the public.

Virtual STM: Virtual STM is a 3D interactive world integrated online games, SNS and virtual exhibition. It combines the characteristics of physical STM to builds a virtual environment, and through communication, integration, contests, activities and other forms, to create a similar scenario with the real world. The internet users can communicate and interact by role play, operate various exhibits and join activities, which will improve the education effect.

Digital Earth about science: Digital Earth about science base on geographic information systems and SNS, add time and space elements in resources storage, and make it easier to show the process of science development and scientific spirit. At the display level, the using of 3D Earth makes the display image and visual. Because of the introducing of SNS and digital map, everyone can mark their own activities in this virtual earth, share their knowledge and sense, and take advantage of the search space to learn other people's discourse on science and technology, and skillfully make study, entertainment, recording life together.

These main modules will be based on SNS and highlight the community affect, and provide the public with better information sharing environment and interactive experience. In addition, according to the characteristic of each group users, CDSTM will create different but unique environment to improve the public's sense of belonging.

The Thinking of Science Communication on Internet

Mass participation and authoritative, correctness

Internet is just a tool, able to spread the truth, but also to spread a lie; to spread science, but also to spread superstition, so in terms of science communication, it may quite a mixed bag. Therefore, we should strengthen the management of science communication on Internet. We should improve the authoritative, Correctness of knowledge in order to guide the public's trustiness and thirst for knowledge, at the same time focus on public participation.

Strengthen the original, Avoid the homogeneity; Focus on updates, Keep up with development of S&T

Although China has a number of popular sites or science column, they are generally less well known, less access, less update, the lack of features and small social influence because these sites belong to different institutions and even individuals. In addition, many content are reproduced with each other, less original content, and a large number of homogenization of information could easily lead to information overload, coupled with the update rate can not keep up, old knowledge or content are difficult to attract the public.

Scientific Literacy of Chinese citizens Survey Results in 2007 showed that in informal education, the main channel of access to scientific knowledge and technological development was television and newspapers, other channels were broadcasting, scientific journals, books, Internet and general magazines. Thus, science communication through the Internet still has much room for development and broad prospects for development.

Internet as a new media, not only has a new features and modes in science communication, but also has a profound impact in promoting dialogue on the whole society.

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208. Spreading News or Panic? A Study Case on Brazilian TV Coverage of A (H1N1) 2009 Influenza

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Abstract. In this study we compare through content analysis the A (H1N1) flu coverage by two Brazilian leading TV programmes: Jornal Nacional (JN), aimed mainly at "hard news" daily broadcasting, and Fantástico,an infotainment program broadcast on Sundays. Both the "hard news" and infotainment programs' coverage peaked in May, had the number of cases or deaths caused by the new flu as the most frequent main topic and used more often as news sources governmental representatives and physicians. Fantástico coverage was more conspicuously focused on the disease spreading; more often relied on the average citizen as sources and voices; and more frequently constructed stories with personalization/human interest angle. Apparently, more than the hard news program, the infotainment program tried to create identification with ordinary people's lives and more fully explored the dramatic potential of the spread of disease.

Keywords: Science journalism; Health coverage

Introduction

Television is one of the major sources of information about science, technology and health/medicine both for the general public and for health professionals. Images that may be evident in society are re-circulated through television (Hodgetts, Chamberlain, 1999). The news provided by television is a source of information that can be accessed regularly, extensively and in a socially recognized way. Depending on choices made during coverage of an emerging disease, television can help to promote panic or to calm its audiences.

In United States and Europe, several studies have found that viewers have been witnessing an increasing number of trivial and sensational stories, or the "soft news", entertainment or infotainment quotient in television programs (Vettehen, Nuijten, Peeters, 2008; Leon, 2008; Uribe, Gunther, 2007). Differently from the "hard news" approach, that is "serious" or "fact-based", concerning "traditional front page and TV news stories which address the important issues of the day" and relying on elite news sources, "soft news involves 'light' or 'human interest' stories" (Henderson, Kitzinger, 1999).

In the northern hemisphere spring of 2009, flu cases caused by a new virus strain were first identified in the United States and Mexico and then spread rapidly around the world. When the Mexican government began disseminating information about the spread of a lethal new respiratory disease, the world media also began spreading the news. On April 27, WHO raised the alert to phase 4. Less than one week after the first alert, new cases were confirmed in several countries, and the alert was raised to phase 5. Finally, on June 11, WHO raised the alert to its maximum, or phase 6 (Allam, 2009; Jones, Salathé, 2009). Brazil, second in the Americas and fifth in the world in population, was one of the countries hardest hit by the A (H1N1) pandemic: 34,506 influenza-like severe acute respiratory cases of infection had been reported as of August 21, of which 16.7% were laboratory-confirmed pandemic A (H1N1) influenza. The first laboratory-confirmed case was detected in Brazil on May 7, 2009, and the epidemic peaked rapidly. On July 16, the first case due to sustained transmission was reported.

Coverage of A (H1N1) has been extensive and may have contributed to high levels of public anxiety. In the United Kingdom, in spite of extensive coverage, a telephone-based survey conducted less than two weeks after verified low levels of anxiety and limited behavioral changes (Rubin et al., 2009). In Saudi Arabia, on the other hand, most people expressed concern about the new flu. Saudi citizens stated they received their information about it mainly through television, newspapers, and magazines, which, along with information disseminated over the internet, may have contributed to a "misinformed dialogue" (Balkhy et al., 2010). In the United States, according to the report "Health news coverage in the U.S. media. January-June 2009," "swine flu was the number one story of the nation" at the height of coverage, that is, during the week of April 27-May 3 (The Kaiser Foundation, The Pew Research Center's Project for Excellence in Journalism, 2009).

The leading Brazilian primetime news program (Jornal Nacional) coverage of A (H1N1) influenza began on April 24 (Medeiros, Massarani, 2010), followed by the same network's infotainment program, that is called Fantástico.

In this study, we compare Fantástico and Jornal Nacional coverage of A (H1N1) 2009 influenza.

Methods

Jornal Nacional (JN) is TV Globo's main newscast. It is the audience leader of primetime television, reaching an average of 25 million people a day. Fantástico is an infotainment program broadcast by the same network (Rede Globo) on Sundays. We viewed JN nightly news and Fantástico programs from April 15 – data when CDC first confirmed the existence of the new disease and it became a potential news subject– through August 31, 2009. Stories about the new A (H1N1) flu began to appear on April 24, but after August 31, they grew sparse and were no longer covered with any regularity. JN and Fantástico stories were studied through content analysis.

We created a protocol of analysis of television coverage of the new H1N1 flu based on a protocol created for analyzing stem cell coverage (Nisbet, Brossard, Kroepsch, 2003) and on the studies of media coverage and risk perceptions of drugs, health risks, and diseases cited as references in this study.

Using this protocol, we collected data on 21 variables, seven of which are described in this paper. We classified each story by the main topics covered: (1) characteristics of the new flu; (2) economic impact of the disease; (3) increase/decrease in the number of cases or victims; (4) prevention or control measures; (5) research and development.

The main frames analyzed in this study were: (1) disease spreading/victimization: focus on the number of suspected, confirmed and/or discarded cases, as well as deaths caused by the 2009 flu; (2) containment: focus on the sanitary measures taken by governmental representatives, companies and citizens to avoid infection or to treat the disease; (3) personalization/human interest: focus on drama or tragedy of people affected by the new flu; (4) scientific-medical background: focus on previous scientific knowledge about influenza and pandemics; (5) economic impact: focus on the economic burden of disease; (6) research and development: focus on the development of vaccines or antiviral drugs fabrication.

Besides main frames and topics, we analyzed: the distribution of stories in time; sources; voices; presence of images of scientists or research laboratories; presence of contextualized information, that is, whether the reporter responsible for a story or the anchor who relayed brief news items made reference to past events, previous epidemiological data, or prevention and control measures in order to afford viewers a broader perspective of the new flu.

Results

JN stories were more frequently broadcast in May, but in July coverage peaked once more. Fantástico coverage, in turn, peaked only in May (Figure 1).

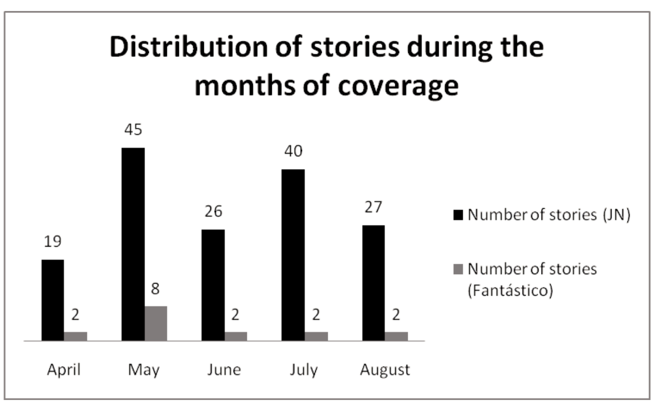

Figure 1. Distribution of the TV stories along the 5 months of coverage

In JN, we found five types of main topics. Increase/reduction in the number of cases (42%) and measures of prevention/control (38%) of the new disease were the most frequent main topics of aired news. Fantástico stories, instead, addressed a lower diversity of topics: only three. Increase/decrease in the number of cases was also the most prevalent subject of stories (Figure 2).

In JN, we found six types of main frames. Containment (44%) and disease spreading (42%) of the new flu were the most frequent. In Fantástico, the new flu spreading (56%) was the predominant frame, followed in frequency by containment and personalization/human interest (Figure 3).

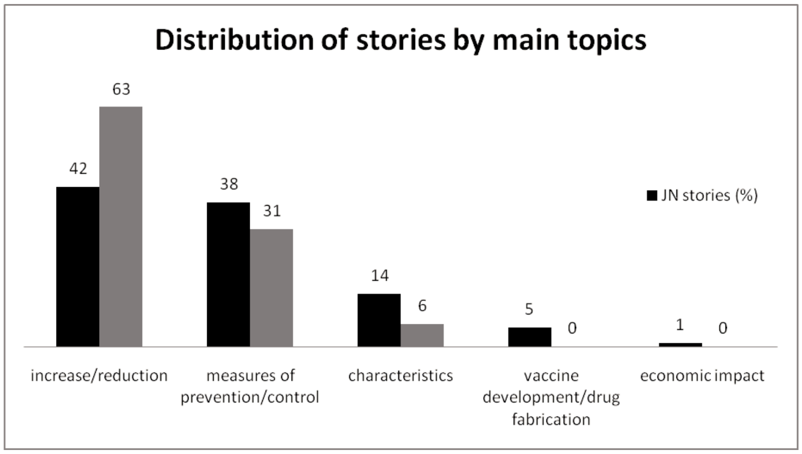

Figure 2. Distribution of TV stories by main topics

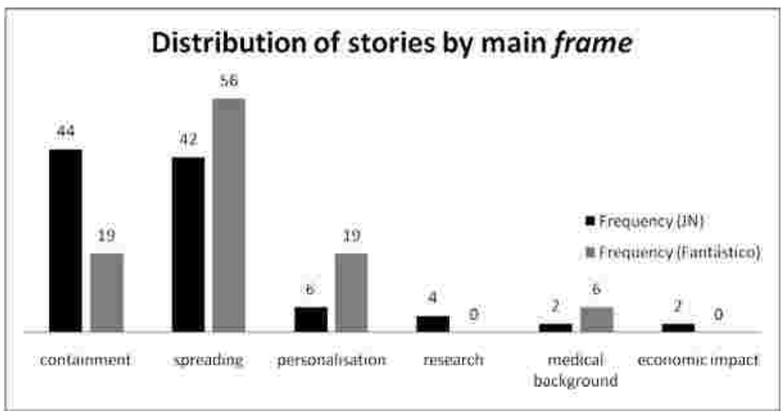

Figure 3. Distribution of TV stories by main frame

In this study, we distinguished between news sources–people and/or institutions responsible for information or opinions used to construct a story–and news “voices”, people and/or institution(s) interviewed to compound the narratives. In JN we found a total of 310 sources; the only expressive ones were governmental representatives (59.4%), physicians (17.1%) and international authorities (10%). In Fantástico, governmental representatives (35%) were also the most common sources, but physicians (27.5%) and the average citizen (25%) were more frequently mentioned. The most frequently heard voices in JN were average citizen (36%), governmental representatives (30%) and physicians (17%). As the figure shows, in Fantástico the average citizen represented a still more frequently heard voice. The only other expressive voice was the physician’s one, which represented 16.1% of the total (Figure 4).

In Fantástico, only 3 out of 16 (or 18.8%) stories showed images of scientists and research laboratories. In JN, 15% of stories

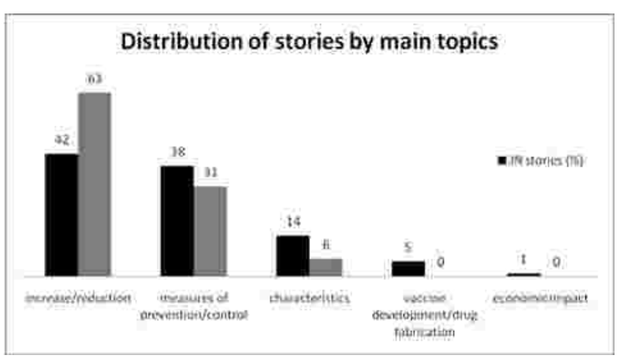

Figure 4. Frequency with which each voice type was consulted by Brazilian TV programs

(or 23) broadcast such kind of image. Contextualizing elements were present in a minority of the JN stories, that is, in only 10 out of 157: 3 mentioned the so-called Hong Kong flu of 1968; one mentioned the 1930s identification of a new H1N1 strain; one mentioned a past but recent political meeting; one talked about the emergence and spread of a new virus from Mexico to the United States, Canada, and other countries; one mentioned actions taken by the Brazilian government after WHO warned the world about a potentially pandemic flu; one mentioned the use of a homeopathic medicine to prevent dengue in one Brazilian state; one mentioned the Fort Dix flu outbreak and 1976 vaccination program in the U.S.; and one was about the 1918 pandemic. In Fantástico, contextualized information was found in only 2 of the 16 analysed stories. One referred to the 1918 and the 1968 pandemics of flu. The other gave some perspective to the emergence and spreading of A (H1N1) 2009 influenza.

Discussion

Both programs' coverage of A (H1N1) 2009 influenza was extensive and peaked in May, but JN coverage peaked one more time in July, when the new disease emerged and "re-emerged," respectively, after apparently declining in relevance in late May and June. The 2009 flu was no longer new but the growing number of cases contributed to the "re-emergence" of the disease as a public health threat.

The prevention or control measures, together with the growing number of cases of new flu and victimization from it, were the most frequent main topics found in JN coverage. Regarding frames, the only two expressive ones in JN were containment and disease spreading/victimization, which fluctuated along coverage (Medeiros, Massarani, 2010). As Young, Norman, Humphreys (2008) remark, equal coverage of both frightening and reassuring information by the media at a similar time can make people "take longer to trust the reassuring information". Media coverage can contribute to raising people's levels of fear, concern, or anxiety, which is necessary to motivate actions leading to a reduction in risk exposure. However, it can also lead the public to take exaggerated self-protective measures or spread a pandemic of fear (Rubin et al., 2009; Fielding et al., 2005). Fantástico had disease spreading/victimization as the most frequently explored interpretive device; the containment frame was found to be as frequent as the personalisation/ human interest frame, which refers to an effort to personalize, dramatize, or "emotionalize" the news (Semetko, Valkenburg, 2000)". Contextualized information was more often broadcast by Fantástico than by JN.

Scientific research had a minor role in both programs. Scientists represented only 3% of people voiced by the "hard news" program and 4.8% of the total of voices in the infotainment program' stories. In JN coverage, the most relevant sources used to construct journalistic stories were governmental representatives, physicians and international authorities. Fantástico also had sanitary authorities and physicians as the most frequently mentioned sources, but in contrast with JN the average citizen was more often used to construct the narratives. Physicians were also more frequent sources in the infotainment program.

The most common voices presented by JN were the average citizens, governmental representatives and physicians. In Fantástico, the average citizens were still more frequent. Our results indicate that sources and voices play distinct roles: whereas sources lend the stories credibility, voices, in turn, contribute to make the topics personally relevant to audiences (Kitzinger, 1999). Apparently, more than JN, Fantástico tried to create identification with ordinary people's lives and more fully explored the dramatic (sometimes tragic) potential of the disease spreading.

Fantástico seems to have privileged disease spreading due to the dramatic potential associated with information and images of infected and dead people. In the coverage of diseases or health risks, not only the "body count" is relevant: it is also important "who are at risk": threats to "people like us" tend to attract more attention than threats to "others" (Kitzinger, 1999). In the case of the 2009 flu, people with great dramatic appeal were among potential and real victims, that is, children, young adults and pregnant women. The potential impact of this kind of story cannot be neglected. Our results suggest that Fantástico, the infotainment program, can have contributed, more than JN to the amplification of risk perceptions regarding the A (H1N1) 2009 influenza. Whether Fantástico coverage could be said sensationalist, however, is a matter of debate.

Acknowledgements

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209. Science Blogs in Regional Languages: An Analysis

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Abstract. The number of Internet users in India has grown from a meager 0.3% of the total population to an impressive 7% over a period of 10 years from 1999 to 2009. With this rate of growth, the Internet, in its true sense, has become a mass media in India. Over the years, the Internet and WWW have been proving us with innovative tools for better and easier communication. Web logs, or blogs stand out among such tools. A blog, simply put, is a type of website. Blogs are usually maintained by an individual with regular entries of text, or other forms of information such as graphics or video. Blogging, for the most part, does not need any specialized computer skills, and can be accomplished using free services available online. Blogs are among the easiest ways to publish content online, involve zero or minimal cost of maintenance, and also provide readers the ability to directly interact with the writer through comments. All these features make blogs an effective medium for science communication. Further, in languages that have limited resources available in the field of science and technology, blogs offer an effective way of quickly creating and spreading content. The fact that the content so created will be freely available and also accessible through the search engines makes the usage of blogs further more attractive. This presentation analyzes an ongoing attempt in Kannada language of Karnataka State in Southern India, which uses a blog for science communication. Among the first of such attempts in the language, this blog called e-jnana (e-Knowledge) has been active for over three years now, and has clocked more than 8500 page views. It is expected that the analysis would provide insight into the role of blogging in the promotion of more interactive forms of science communication, especially in the regional languages.

Keywords: Science blog, Kannada, Blog

210. Science Communication through Mass Media

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Abstract. The earliest origin point of the science communication can be marked when the man invented the fire kindling technology. Then slowly he prepared himself to draw the cave paintings. The invention and dissemination of fire kindling technology is considered as first science communication. Now we are in digital age. This digital is also called as Entertainment Age. In this age only the science communication shifted from the elite people to common forum. This shift is due to the media revolution in India for last two decades. Today media play the role of–to educate, to entertain and to inform sensitively. The first role of media is mostly done by special interest magazines. In those farmers's magazines, science magazines have a great role to educate the society. In Tamil Nadu, Ananda Vikatan is successful running magazine for more than 80 years. From Vikatan's publication a farmers's magazine called Pasumai Vikatan. The readers of this Pasumai Vikatan magazine are mostly farmers. The purpose of the present study is to find out the coverage of agriculture news in Tamil magazines. This research addressed the following questions. What is the extent of agriculture coverage in Pasumai Vikatan? What are the content characteristics of agriculture content in Pasumai Vikatan? What is the style of coverage in Pasumai Vikatan?

The present study employed qualitative content analysis to study the coverage of science in Pasumai Vikatan. The sample period chosen was between 2007 and 2009. The researcher used non probability sampling method for sampling issues. By employing available sampling method, the researcher collected 18 issues. The magazine purely dealt with the agriculture. The magazine became the hand guide for the farmers. For example, the 'Magasool (Harvest)' seriously deliberate the information for harvesting various crops. 'Tandora' another part of magazine help the readers to intimate the various conferences and workshops that will held at various parts of country. 'A Chat under Tree' is a conversation method of discussing the advantages and disadvantages of tools and techniques used in agriculture. And also the magazine is interested to publish all the aspects of farming. It also acts as a guider to compare the modern techniques with the old one. The colorful photographs with the scientists interview add more essence to the magazine.

211. Researcher or Attention Grabber?
Is Intellectual Property a Means to Communicate Scientifically?

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Abstract. Scientists and researchers have been using publications and Intellectual property as a means of scientific communication. But in an endeavor to protect their works they seem to be losing the essence of science. Science is a collective effort where the results obtained in one scientific exercise are used as the input for some other scientific production.

The author in this literary article intends to outline the paradox that the scientific world needs to solve. Is a scientific invention somebody's intellectual property that he/or she only has a right to deal with in a manner he/she thinks is appropriate or should the moral responsibility of a scientific mind be to share with all humanity without prejudice whatever science and nature reveals to us.

This paper briefly goes into the historical background of the Laws relating to Intellectual Property Right in the world and also in India in Particular. It deals with the question of the conceit of a scientist and how it hampers the progression of knowledge.

This paper also deals with what are the main motives behind engaging in scientific quest and what is the role of scientific communication in it. It deals with the insecurities of a researcher and the desire to get attention from the scientific community being the force driving the scientific communication today.

Keywords: Scientific pursuit, Intellectual property right, Intangible, WIPO, TRIPS, WTO

Introduction

Science (Latin word meaning 'knowledge') is the systematic knowledge of the physical or material world gained through observation and experimentation and 'Scientific pursuit' is a method of research in which a problem is identified, relevant data are gathered, a hypothesis is formulated from these data, and the hypothesis is empirically tested. But for a person wishing to gain scientific knowledge or trying to tread on a path of scientific pursuit it becomes imperative to gain a coherent picture of the sources and developmental stages of scientific ideas. Without this, 'Science' may seem to be a random collection of formulae and laws.

What nature reveals to us as scientific facts or the truths are put to productive use only when they are interrelated. Any person, may it be a student trying to gain some scientific knowledge or a researcher carrying on with some research activity can understand and appreciate the significance of this productive utilisation only when the various developmental stages and their interrelationships can be traced by him or her.

When a scientific mind or a number of them together create a new invention or come across a great discovery, there is definitely a great sense of achievement and pride associated with it. But along with this sense of achievement and pride there also sets in an element of insecurity. What if this great innovation or creation, achieved at an enormous cost in terms of funds, intellectual investments and human efforts, gets stolen or copied by somebody? Why shouldn't law permit him/her to safeguard this creation as his/her own property? Why can't this intellectual property be treated as an asset and purchased, sold, gifted or bartered as any other form of personal property?

The answers to all these insecurities of a scientist or researcher need to be addressed with great caution because of the intangible nature of intellectual property. It is this intangibility and perceptibility that sets apart intellectual property from other forms of personal property, and hence the requirement for some special laws and regulations. Intellectual property is a broad concept that covers several types of legally recognized rights arising from some type of intellectual creativity, or that are otherwise related to ideas[1]. Intellectual Property Rights(IPR) are rights to intangible things[2]—to ideas, as expressed (copyrights), or as embodied in a practical implementation (patents).This very idea of giving property rights over ideas, processes, inventions and other such scientific creations calls upon a debate on their moral justifiability.

Creativity requires a greatly varied and unrestricted public domain. Growth in science and technology is a cumulative process, with each new contributor working and developing his models and theories based on the inputs from the works of others who came earlier. IPR, in granting special rights over such intellectual property, not only grants ownership to the creator, it also awards a monopoly to him or her over his creation. This denial of the unrestricted public domain for creativity and scientific pursuit can immensely hamper the progress of science and technology.

Thus, the big Question the world of science and technology faces today: Is a scientific invention somebody's intellectual property that he/or she only has a right to deal with in a manner he/she thinks is appropriate or should the moral responsibility of a scientific mind be to share with all humanity without prejudice whatever science and nature reveals to us?

Intellectual Property Right: Historical Background

Globalisation has taken place at a rapid pace from the 19th century through the 20th and continues in the 21st century. This can be observed in the ever increasing flow of goods, investments and ideas across the international borders. Intellectual property which is the creative work of the human intellect, has also assumed importance throughout the world in the recent past.

The Historical Background of Intellectual Property Right can be traced as follows:

(i) Coordination of IPR at the international level started in the 19th century at the Paris and Berne conventions. These were combined in 1893 and the combined entity functioned under several names, the most recent being BIRPL (French acronym for United International Bureau for the Protection of Intellectual Property).

(ii) It became the main subject matter of the World Intellectual Property Organisation (WIPO), established in Stockholm on 14th July, 1967. WIPO became one of the sixteen specialised agencies of the UN in December 1974 and was responsible for taking appropriate action for promoting creative intellectual activity and for facilitating the transfer of technology related to the intellectual property to the developing countries in order to accelerate their economic, social and cultural development.

(iii) A landmark development in the international economic relations was the successful conclusion in 1994, of the negotiations on the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). TRIPS has now become a part of the legal obligations of the World Trade Organisation (WTO). Thus Intellectual Property has also become a part of the WTO- the only organisation dealing with the rules of trade between nations.

So, What is Intellectual Property and the Paradox?

The motivation behind the protection of Intellectual Property is to encourage and reward creativity. Statutory protection is given to the rights of a creator in his creation and also to the rights of the public in accessing these creations.

According to art 2 (viii) of the 'Convention Establishing the World Intellectual Property Organisation (WIPO) 1967', intellectual property includes rights related to (i) literary, artistic and scientific works; (ii) performance of performing artists, phonograms and broadcasts; (iii) inventions in all fields of human endeavour; (iv) scientific discoveries; (v) industrial designs; (vii) protection against unfair competition; and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields.

Intellectual property, from the point of view of communication in Science and Technology, is usually concerned with (a) Copyright, (b) Patents as Industrial Property. It becomes imperative here to understand the meaning of the above mentioned two branches and the controversies, if any, associated with both.

Copyright: The copy right act grants to the owner of copyright various exclusive powers like right to reproduce the work in any material form; to issue copies of the work to the others; to perform the work in public or communicate it to the public in any manner. The main objective behind laws related to copyright across nations should be to promote the progress of science and useful arts.

The Indian Copyright Act, 1957 provides that copyright shall subsist in a published work within the lifetime of the author until sixty years from the beginning of the calendar year next following the year in which the author dies. In a similar manner the Copyright Act of the United States of America which is largely based on the British statutes grants a copyright during the lifetime of the author and another seventy years from his death.

The question most crucial at this stage is that whether the State should have the power to curtail the exclusive ownership rights of an author, to a limited period? Why should his rights in his intellectual property not flow from one generation to the next, as is the case with his material possessions? Why should his children and grand children be deprived of their legacy sixty years or so after his death?

The only way this problem can be answered is by looking at the fact that the Copyright Act grants a monopoly where no such monopoly really existed. If Kirchhoff had taken a copy right on his Current and Voltage Laws, instead of introducing them as a foot note in one of his research papers, all the developments in Electrical technology would have surely got a severe setback. One has to understand that the Copyright is not a natural right but is a virtual right, created to give certain benefits to the author that work as an incentive to pursue the path of creative innovation. Expiry of this right should not be a deterrent in the process of acquiring and disseminating knowledge. But at the same time, it has to be kept in mind that the public or society definitely has a right to free trade and expression.

Patents/ industrial property: Industrial property refers to creation of human mind in the form of inventions and industrial designs. Inventions here imply new answers to scientific and technological problems whereas Industrial designs refer to new appearances of industrial products. Patents provide an exclusive right to an inventor to use his invention for a certain period of time provided the invention (a new product or process) made is new or novel, involves an inventive step and has some industrial application.

Patents Laws were historically developed to give the inventor an appropriate share in the benefits from their inventions. This is done by giving the patent holder a form of exclusive control for 20 years from the filing of the patent. The Patent Law got extended to an array of inventions, over the 19th and 20th century. The originality required for an industrial design to be patented has become a questionable area. Till the early 20th century, plants being products of nature could not be patented. But the Plant Patent Act now provides a special form of patent protection and this has been extended to cover new and distinct sexually reproducing plant varieties. A patent was granted to a U.S company for a compound in the neem tree which is a native subcontinent. Its usefulness and free availability throughout India and its applications in traditional Indian Ayurvedic Medicine, agricultural and household use made it Gandhi’s favourite tree. Now with such patents being granted, it is possible that Indian citizens may be required to pay royalties on the products produced from neem.

Patenting of any life form is unethical as it results in commoditization of life forms. Living organisms are products of nature but the judiciary by a narrow margin of five is to four changed this status when it decided that a strain of bacteria that were modified by insertion of new genes was patentable because it was not naturally occurring and was expected to be useful for cleaning oil spills. The patent granted to the “Harvard Oncomouse”, the first animal to be considered an invention set up a trend towards patenting genetically modified complex living beings.

Patenting of human life in the form of human genes, cell lines and tissues is being defended on the basis of the arguments that products of nature once used to produce a form not possible outside of a laboratory should be patentable. The University of California was granted a patent for a cell line removed from the cancerous spleen of a leukaemia patient while the California Supreme court decided that he did not have a right to his own cells once they had been removed from his body.

Bioprospecting or collecting natural products is considered the latest in the field of science and technology. Biospectators keep looking for the rich genetic resources and the indigenous knowledge of the Third world and this result in the indigenous communities having to pay royalties for products based on plants and knowledge that actually belong to them. The bio resources are for common heritage of the mankind and cannot be allowed to be patented at any cost. That these resources are under constant threat from the developed countries was learnt by India the hard way when Suman K.Das And Harihar P. Cohli were granted US patent 540,504 on 28th March 1995 on the use of Turmeric as wound healer. The patent holders were Non-resident Indians and the Council for Scientific and Industrial Research had to fight to revoke these patents. Similar patents were granted to extraction and storage processes of neem ; to Rice Tecc Inc. on Basmati lines and grains by the USPTO which had to be fought by India

One dreads to imagine how the evolution of mankind and the story of civilisation would have suffered, had the person who first created fire by striking couple of rocks against each other decided to patent his process of producing fire. Aristotle believed, and rightly so, that the sense of property cannot exist without sense of liberty. If one considers, ones intellectual property right acquired in the form of a patent ought to be perpetual and to be treated as sacrosanct, what happens to the liberty of others?

Conclusions

Though copyrights and patents seem to be property from the creators’ point of view, they also restrict the concept of liberty from the society’s point of view at large. Intellectual property is definitely different from the physical property and needs to be dealt with great caution. While protecting the rights of a scientist to the products of his labour and intellect and while providing an incentive for future investments and inventions, the Laws governing the Intellectual Property Rights should also allow the works to be made open to the public to be used with other new innovations for the benefit of mankind. Intellectual Property needs to be shared freely for the good of the society and hence needs to be put in the ‘Public Domain’ but at the same time, rights of the creators need to be protected. What has to be observed and respected is the line between overprotection and under protection and the classification of innovations and creative ideas that should or should not be granted this protection need to be done with great precaution and with only one purpose in mind and that is—Not to curtail the Rights of researcher by denying them the knowledge related to any developmental stage or depriving him or her the use of any earlier innovations that would help in their scientific pursuit . Let the tools of communication in science and technology be used for promotion of growth and betterment of science and technology and not to protect the conceit if a researcher or a scientist.

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212. Reaching the People through Science Communication by Bridging the Gap between the Experts and Activists

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Abstract. Scientific discoveries and technological breakthroughs that hit the headlines make public curious about their implications. Experts and activists in the relevant fields have their own approaches and the public often do not get the information in the right language or with the right perspective from them. The science communicators are expected to reach people striking a fine balance between these two sections viz. experts and activists. But the lack of media encouragement and proper training remains a hurdle for quality enhancement in science communication. In a democratic set up science communicators play an important role influencing the policy framers also.

Keywords: Activists, Experts, Science communicators, Socio-cultural aspects

Introduction

India has a significant number of people trained in science and technology. But considering the overwhelming population the percentage of this people compared to the total number of people having basic education is really not that large. The society does enjoy the fruits of technology in a big way but takes interest towards science particularly the younger ones more as an attractive career option and not as an area worth knowing to take part in different social, cultural or political processes in a democratic society. People now come across newer technologies and innovations that often affect their lives with every passing day. Be it a new type of mobile phone or any other device, be it a new type of accessory fitted in a car for the reduction of emission of polluting gases or a new medicine, people get the fruits of research and adopt themselves with that. But the different aspects that include the socio-cultural and ethical as well as the commercial ones associated with the newly adopted technologies and innovations or research outcomes apparently do not attract attention of the common people. With the spreading of horizon of knowledge and fast emergence of branches and sub branches of different scientific disciplines it is becoming more and more difficult to keep track of the developments taking place in the research arena.

Newer areas are coming up where the new set of experts are taking the centre stage and are explaining newer observations and findings in a narrower field of study where vertical spread of knowledge is taking place in a big way. The experts, quite expectedly, try to stress on the rigor of the scientific information. This approach in the process does not give the people's understanding the topmost priority and the language or style of presentation often do not reach or touch the people in a big way. On the other hand we have a section of activists, not all, who know their agenda much better than the science and technology involved in the issues and often come up with a truncated or biased view particularly on the social, cultural or ethical aspects of the scientific and technological issues. The science communicator is expected to chart out her track through this by judiciously bridging the gap between the two approaches that sometimes may be referred to as contrasting.

The challenge of communicating science

A science communicator begins her work in this scenario where she finds the experts at the one end and the common people at the other. But the bridging the knowledge on one side and the views and opinions on the other side becomes a very challenging task because of several factors. It is true that the people on both sides who are interested in healthy discussion and exchange of observations not be very large. But the necessity of this exercise can only be overemphasized since whatever little information common people may collect likely to come from either of these two sources. Different innovations in science and technology nowadays affect the lifestyle, social and educational and even emotional set ups in an individual in a significant way. This may illustrated with an example. If we just look back to the introduction of the use of mobile phones in this country say about a decade back, some interesting things come to the fore. It was considered to be a rich men's 'ornament' and most of the people did not have the iota of an idea how this technology is actually going to govern the daily chore of a person however ordinary he or she might be in a very short span of time. Computers that have virtually taken an all-pervading role in our life entered the public domain barely fifteen years back. Now as it happens whenever this sort of technological innovations become parts of our lives different perceived aspect about them are highlighted, sometimes deliberately by different interest groups. One would be able to recollect that there used to be a lot of campaign against the introduction of computers in the manpower intensive sectors where people developed an alarming feeling that the computers would become the cause for their loss of job. The way different political groups and trade unions highlighted this aspect and tried to whip up some sort of neophobia among the common people indeed created a very strong case for the science communicators. The role of science communicator in such a situation becomes so significant that they can form the public opinion with the right perspective. Now people possibly agree that computers on the one hand became the cause of a few types of jobs while nobody could anticipate the huge type of jobs that it would create. In fact with the emergence of newer software and development of hardware and cost reduction in recent years are actually making the computers integral parts of life even in a not so developed society. The benefit of introduction computers in so many sectors has now actually reached the very common man in the form of railway reservation of ATM services offered by the banks.

The science communicator is expected to identify these areas and with the help of different forms of media can try to present the right scientific idea along with their possible implications, of course keeping in mind the social perspective. Science communicators normally come with the background of one or the other discipline of science but with the addition of newer ideas, concepts and innovations practically with every passing day their background even in a field where he or she had some basic training in her student days proves to be inadequate to comprehend a number of newer aspects. We have to appreciate the daunting task of the science communicators as a group of people who are acting as a link between experts and common educated section of the society.

Quality enhancement: The role of experts

A science communicator cannot see through the interesting aspects of different branches of science. It is also not possible for him or her to keep track of the vast load of information on science that is now available. Moreover it is indeed expected that the science communication should be context based to make it attractive to the readers, viewers or listeners depending on the medium. This section of the society may be identified as educated common man with interest but not much of knowledge in science. Particularly of we keep in mind that with the spreading of knowledge horizon very fast newer branches and sub-branches of different scientific disciplines are regularly emerging.

In a huge country like India interested population spread across the country cannot access the expert opinion on different issues directly. Not a very large section has the access to Internet of other modern facilities to enrich oneself even if there is a will. An interested citizen cannot attend popular or semi-popular lectures, discussions or talks on issues they are concerned in as most of these are confined to big cities or metropolises and sometimes remain out of bounds of the experts. That in a way entrusts a big responsibility on science communicators who can really communicate the views of the experts to the common man in a form and language that people understand. Quite often lots of ideas related to S &T make round in the society that needs to be handled in the right perception. For example, people come across occasional newspaper reports on the possible link between cancer and the use of mobile phones. Lot of campaign goes on in the cyber space with the circulation of forwarded e-mails that warn people about the special significance of a particular date etc. Most of these do not have any basis but the science communicators can actually present the experts' views after consulting them. If these views are non-convergent that also common people get a message that is worth studying.

The experts normally do not want to part with the views they hold as that is normally based on scientific rigor. That often makes their language and style of communication such that the common man finds it difficult to absorb. The science communicator's role lies here. He must have the right kind of scientific input from the expert if necessary through some structured questions and try to present the matter to the general public with the right perspective. He may add on his views and predict the future implications after judicial analysis. A close connection between the science communicator and the expert is so essential that there should be an international effort for maintaining this. For example the international bodies can think of developing a large pool of scientists, technologists, researchers from all over the world and they may be accessible through e-mail and other modes for helping out the science communicators in their pursuit. These experts may put up their explanations and views on different scientific issues to be made use by the science communicators.

Activists and non-governmental organizations (NGOs)

In India like in the rest of the world the NGOs are working in large number of sectors where they are supplementing the governmental efforts for the betterment of common man's life. So these fields among other things include 'scientific awareness campaign' involving environment, energy, health, and sanitation related issues. With due respect to a section of these activists who working under different NGOs this has to be mentioned that a much larger section of these people often try to sensationalize an issue instead of giving the right scientific input. Considering the background of these activists this is in a way is not surprising but their reach to the people particularly the younger people through school programmes cannot be ignored. They take up their work more as a routine duty and not as a commitment to the society. As such these efforts should be there to supplement what the experts or the government efforts are doing but often they tend to ignore the mainstream efforts highlighting their own. The use of nuclear power is a typical example in this context. The activists who are anti-nuke go on harping, sometimes exaggerating the evil aspects of the nuclear power. They often do not see anything positive about the nuclear power and this approach turns into a campaign and not a scientific deliberation. Let me stress that only a section of activists fall into this category. One can respect the commitment of an activist to a cause but he or she may not be the best person to learn about science from. Once again we need to look for a science communicator who on one hand may partially use the campaign materials but can come up with a balanced view with other inputs from the experts. This can then help our citizens to form what is known as informed opinion.

So a science communicator does need to maintain close link not only with the experts but with the activists as well. A science communicator needs to check what sort of inputs on a scientific issue has gone to the general public particularly to the younger generation through the campaign of the activists. Sometimes these campaigns come as some sort of a mantra or rhetoric without any explanation of the context. The campaign against the use of plastic and its different products is possibly a case in point. While the proper disposal of plastic bags or poly bags remains issue often this leads to a campaign of total elimination of plastic from the scenario. If the science communicator can actually help the activists putting more scientific content in their arguments along with their zeal a wonderful job can be done for the society.

Need for some initiatives

A few very important and relevant questions loom large particularly in the Indian context. What sort of qualification a science communicator is expected to possess since she is expected to deal with a formidable task in the present day scenario? Do the different media, electronic, print or audio employ or at least engage a science communicator? Is there any facility for imparting training to the youngsters who want to pick up science communication professionally or even as a part-time pursuit for the love of the area and work? Because of the non-availability of any satisfactory answer to question the ultimate question comes up; who would be a science communicator? Well, this is another gap that needs to be bridged if we want to have very responsible well-meaning people coming in and enriching this field.

It has been observed that a significant number of people involved in science communication are graduates in some branches of science. These people do put up efforts to upgrade them in science related information thanks to the Internet and world-wide-web. But it is also imperative that a single person cannot follow the interesting and critical developments taking place in different branches of science and technology. Or it is not possible to understand the significance of all the science related news hitting the headlines. The recent news of the LHC (Large Hadron Collider) is a case in point. And the role of experts in these situations is even more important. However we cannot deny that some basic training also needs to be arranged for the science communicators. Unfortunately in India, different Academies of sciences and engineering have not taken up this issue with the desired degree of seriousness. A few scattered efforts in a very modest scale have been observed but there need a lot of planning and once again the inputs from experts not only from the different fields of science and technology but from the people who help in developing writing and communication skills, people who can efficiently handle computers and possibly some serious readers. The exercise also demands the inputs from the policy framers who decide on the channelising the funds earmarked for the research in science and technology in the right direction.

Some well meaning organizations in different parts of the country run some training programmes for science communicators. Interestingly, they do not get enough participants who have pursued science up to the graduate level. There are commerce or arts graduates who read science up to 12th grade even occasionally up to 10th grade. Notwithstanding the seriousness and sincerity of these young people they must be put to some rigorous training so that they can take up their work of science communication in a bigger way. The database of the experts from the different fields has to be developed and maintained. These experts are expected to respond to the science communicator's queries and help them in communication the correct science. Since the profession of science communication has not emerged as a whole-time vocation with support from different sectors, the work is mostly undertaken by people who are actually associated with other professions for their bread and butter. So some support should be planned and organized for the quality enhancement of this profession.

Concluding observations

In India science communication has not been able to emerge as a whole-time vocation is spite of what is called electronic media boom. Moreover there is a reasonably large print media with wide reach that really does not much bother about science news. The English language media whatever material they publish or deal with take them directly from different international agencies and publish directly. So the Indian angle or implication to the Indian context remains unaddressed. The vernacular press does not show much interest about science. The science communicators actually work with this backdrop. So the motivation does not reach a very high level and their importance in the media sector remains somewhat tiny.

With the changing economic canvas and the impact of globalisation has brought in much better flow of money in scientific research in India. Projects involving large quantum of money is being sanctioned in different fields of research. In this democratic country the policy framers are essentially the elected representatives of the people. They actually need to gauge the people's mood while making different policy decisions including the sanction of funds for different scientific projects. Once again the science communicators can play a very important and significant role in forming the public opinion leading to the more accountability of the scientific community. This in turn makes the experts appreciate the need for communicating with the common people so that the inflow of funds remains in tune with their need. And this would lead to situation where the experts, activists and the science communicators will work in tandem supplementing each other and evolving the right environment of doing science with total involvement of the society at large.

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213. Science Coverage in Regional Newspaper: A Case Study of Two Newspapers from North East India

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Abstract. This case study is an attempt to examine and understand science coverage in newspaper from the geographically isolated North Eastern region of India. The study analyzed science stories published in one major English and one major Hindi language daily published from Assam during the month of May 2009. Dainik Purbodoy focused mainly on health (79%) whereas The Assam Tribune focused on health (39%) and environment (32%) related issues. Almost all the stories of Indian origin from both the newspapers were from Assam only, highlighting that the location of publication may influence the quality of coverage.

Keywords: India, Regional newspapers, Science coverage

Introduction

The spread of knowledge of science and technology is important as it not only creates awareness among common people about the latest developments but also may serve the purpose of solving some of the regional and local problems through proper dissemination of scientific information. Advancement in science & technology is reflected not only in the media itself but also in its functioning. Science needs different media for maximizing its reach. Public exposure to information is the first step in public understating of science. Media here can play an important role in dissemination of information and different time preference for various media consumption (Table 1) signifies that although the advent of advanced audio-visual media technology has affected but not diminished the preference for print media. A growth of 12.8% has been observed in the print of dailies from 2005 to 2008 in India1 and till March

2008 there were 88,763 no of registered newspapers in India with highest number registered in Uttar Pradesh followed by Delhi and Maharashtra2. None of the states from the North East India featured in the top ten, although, North East India has 8 states comprising only 7.9% (2.62 lakh sq km) of the total geographical area of India. The region is characterized by poor infrastructure, difficult terrain, geographical isolation, poor socio-economic conditions and a low rate of growth but is one of the major biodiversity hotspots of the world. Assam and Sikkim are the only two states which bring out dailies in Hindi language3.

Table 1. Time of media consumption (in %)

	TV	Newspaper	Magazine	Radio	Internet
Early morning to breakfast	5	33	7	18	2
Breakfast to lunch	6	38	21	18	21
After lunch	21	23	44	21	51
Evening until dinner	37	6	21	31	24
After dinner	32	1	7	12	3

Source. www.mruc.net

Global science coverage

This Scarcity of studies, which have tried to analyze science coverage particularly with respect to the newspaper being printed from North East India is the reason behind the present investigation. Few studies have tried to analyze the extent and behavior of science coverage in Indian newspaper4,5,6 and they have concentrated mainly on English language dailies only. On average, Indian newspapers devote far less than one percent of the total printed space to articles and stories related to science and technology4 though India ranks 12th in science and technology, with its global research publications share of 2.04%. Assam is Low Productivity State in S&T publication and ranked

19 of the 37 states & Union Territories of India. Top was Tamil Nadu followed closely by Maharashtra and Delhi. Globally US top the list with publication share of 25.32% followed by UK, Japan, Germany, China and France (their global publication share ranging from 4% to 7.13%)7. Earlier studies have suggested very little science coverage in newspapers worldwide. Newspaper from UK, Greece, US and Australia devoted about 5%, 2%, 2% and 2.9% of the total space8.

Methodology

English language dailies readership (18.59%) is second only to Hindi (27.54%)9. In some states like Chandigarh, Delhi, Maharashtra and West Bengal, the circulation of English-dailies exceeds that of Hindi-dailies. Based on the readership status, The Times of India (all editions) tops the list in English with 133 lakh readers and Dainik Jagran

(all editions) in Hindi with 557 lakh readers10. The present study aims to study the Science coverage in regional newspaper from North East India. Two newspapers were selected for one month long study, The Assam Tribune in English and Dainik Purbodoy in Hindi -. Both the newspapers are published from Assam, The Assam Tribune from Dibrugarh and Dainik Purbodoy from Jorhat. These newspapers were selected because they are one of the major dailies of Assam in their respective language of publication11. The Assam Tribune completed 70 years in 2009 while Dainik Purbodoy though recently started has attained popularity in short span of its existence. The study was carried out for the whole of May 2009. The stories retrieved formed the subject matter for the present study. The stories were subjected to both the qualitative and quantitative analysis. The subjects of the news stories were identified from both the title and the contents. Each story was also categorized on the basis of its type of work it represented like research, reporting of events, general article etc. The data was analyzed in terms of space covered, geographical origin of stories, illustrations prominence of news etc.

Result and Discussion

The total number of items collected from both the newspaper was 88 with 42 in Dainik Purvoday, an average of 1.35 articles/day and 46 in The Assam Tribune, an average of 1.48 articles/day. A different publication pattern is visible when the number of stories was plotted against date (Fig. 1) during the study period. The Assam Tribune published more number of science items on lesser number of days ranging from 0 to 8 stories/day. On the other hand Dainik Purvoday published regularly with maximum frequency between 1 to 3 stories/day. Arya, 2007 observed an average of 1.2 stories/day/newspaper published in five English dailies from India which is comparable to the present investigation6. In another study Luisa Massarani et al, 2005 who studied electronically published science content of seven newspapers from Latin America (Argentina, Brazil, Chile, Ecuador and Mexico) found average stories published/day in the range of 0.8-3.612.

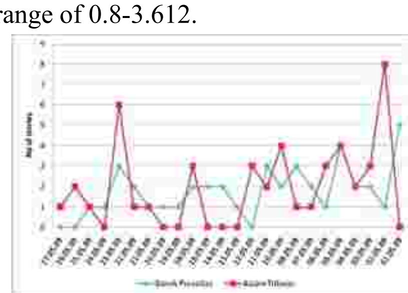

Figure 1. Datewise publication of stories

Knowledge Area

The topics covered were identified from both the title and the contents. A total of 12 different subject/areas were identified under stories during the study period (Table 2). The 46 stories of The Assam Tribune were covered in 8 areas whereas 42 stories of Dainik Purvodoy were covered in 9 of the areas. The dominance of different areas covered in both the newspaper is clearly visible from the table 1. The Hindi newspaper focused mainly on stories related to health (79%) whereas English newspaper covered both the health (39%) and environment (32%) related issues almost equally. About 13% (6) of the news story during the study period in The Assam Tribune dealt with biodiversity conservation and 4% (2) were related to animal behavior and science awareness. When compared 7% (3) of the news story in Dainik Purvodoy were related to Biodiversity conservation and all the three news were related to observing of some rare or extinct species.

Table 2. Topics covered in number (%)

Topics	The Assam Tribune	Dainik Purvodoy
Animal behavior	2(4.35)	1(2.38)
Biodiversity conservation	6(13.04)	3(7.14)
Biotechnology	1(2.17)	-
Botany	1(2.17)	-
CSIR Technology	-	1(2.38)
Energy	-	1(2.38)
Engineering Sciences	1(2.17)	1(2.38)
Environment	15(32.61)	1(2.38)
Food & Agriculture	-	1(2.38)
Genetics	-	1(2.38)
Health	18(39.13)	32(76.19)
Science Awareness	2(4.35)	-

As far as the research publication is concerned Medicine, chemistry, physics, agricultural & biological sciences, engineering, biochemistry, genetics & molecular biology, and the materials science are the seven high productivity subject areas of research in India during 1996–20067. This is reflected in a recent study of 31 English dailies where Dutt et al, 2008 observed that maximum number of items published were in the area of health, followed by environment, astronomy, biological sciences and space science and technology. These five subjects together accounted for 72% of the items. In another study Arya 2007 also found that content of five English newspapers was dominated by medical sciences related research news items6. Similar trend was also observed among Italian newspapers which was found dominated by biology and medicine accounting for more than half of all articles (52.7%) followed by engineering related items (14.7%)13. Massarani and Buys (2007) also found that medicine and health related stories dominated Latin American newspapers14. Similarly UK newspapers also seem to be dominated by health/medical. Other subjects which finding favour in UK newspaper are related to Environmental, biology and Technology8. At times phenomenal increase in an area of knowledge at particular time has been observed that may be attributed to the occurrence of certain incidences which lead to hyped coverage12.

Experts/journalists

Misreporting of the science news at times by journalists emphasizes on the need for science graduates to take up journalism as career and increased contribution by the subject specialist. In the present investigation if we exclude the stories where no name or only the name of the writer without any affiliation is mentioned then overall only 3% (3) of the science based stories were written by subject experts. 'Natural disaster preparedness' by Former head of Geography, Gauhati University and 'Living with earthquakes' by consultant Engineer & Secretary, Indian Society of Earthquake Technology were the only two stories during the study period which were written by subject specialist. In contrast only one health related article in Dainik Purvodoy was written by a subject specialist i.e., Brig (Dr) Ved Chaturvedi, Director & Arthiritis Specialist, Sena Hospital, Guwahati. The data suggests that though the contribution by subject specialists like scientists, professors/faculty, health and engineering professionals etc is still negligent in regional newspaper and needs to be increased exponentially. In contrast, 17.1% of articles in Italian newspaper are written by scientists or doctors13.

One of the main objectives of the present investigation was to highlight the contribution of science journalists and subject matter specialist to the science stories in the newspaper. It was observed that in the case of The Assam Tribune, 19% (9) were written by staff reporter or correspondent and in addition further 26% (12) carried the name of the writer taking the total contribution to 45%. In the case of Dainik Purvodoy only 7% (3) of the stories had the name of the writer mentioned whereas further 5% (2) were written by staff reporter or correspondent. There was writer's name/source of stories mentioned in 88% of the stories in the Dainik Purvodoy. It is not possible to draw conclusion based on the name alone whether the writer is journalist or specialized science writer. To get a clear data further investigation involving communication with the newspaper/writer is required which is the limitation of the present study.

Presentation Style & Illustrations

Both the newspaper showed marked difference in the presentation style of stories covered. The presentation styles were categorized into research based news, general article, interview, reporting of an event (seminar/conference/workshop etc), new product/technology developed etc (Table 3). The Dainik Purvodoy predominantly covered research based news (73%) followed by 14% of stories written in the form of informative article whereas in The Assam Tribune 43% stories were written in informative article manner followed closely by 32% research based stories. A clear difference can be seen that about 17% of stories in The Assam Tribune reported the occurrence of events like conference/seminar/workshop related to health or S&T which is clearly absent in Dainik Purvodoy. Less than 5% of the stories in both the newspaper were interview related to new product/technology. Easy availability and reliability of journal publication to highlight the recent scientific discoveries may be the reason behind very high percentage of research based stories 73% in the Dainik Purvodoy and 43% in The Assam Tribune.

Table 3. Presentation style in No (%)

Type of story	The Assam Tribune		Dainik Purvoday
Article			
20(43.48)	6(14.29) Event reporting		
8(17.39)	- Interview		
2(4.35)	1(2.38) New		
product/technology	1(2.17)		
2(4.76) Photo			
-	1(2.38) Press Meet		
-	1(2.38) Research		
based	15(32.61)		
31(73.81)			

To appeal to the readers catchy headlines and illustrations are often used. This was proved true in the case of Dainik Purvodoy where 78% (33) of the stories had some illustration. Of these 72% had photographs and 24% had cartoon. The remaining 3% had combination of both the photograph and cartoon. On the other hand The Assam Tribune science stories lacked illustrations with only 9% (4) having any visual. Overall more than a third of the stories carried some illustrations. On average more than fifty percent of the Indian English dailies used some form of illustration whereas in the present study about 42% of the stories from the regional newspapers used illustrations. Rooyen also observed that the daily newspapers in south Africa used maximum amount of infographics while none of the science stories in the regional newspapers used infographics15.

Geographic origin

The information regarding the country of origin of the event or activity of a story could be traced in respect of only 82 stories (Table 4). The origin was identified from the content of the stories. These 82 stories had their geographic origin from seventeen different countries, of which 61% from The Assam Tribune and only 17% from Dainik purvodoy had their origin in India. All the news from India had their origin from Assam only, not even single news was from other North Eastern states or from the rest of India. As far as science for outside India is concerned Dainik purvodoy covered 33% of news originating from USA followed by Australia (12%).

Table 4. Geographical origin of the stories

Country	The Assam	
Tribune	Dainik Purvoday Australia	
-	5(11.90) Bangladesh	
1(2.17)	-	
Belgium	-	
1(2.38) China		-
1(2.38) Denmark		
1(2.17)	- England	
2(4.35)	4(9.52) France	
1(2.17)	- Germany	
-	1(2.38) India	
28(60.87)	7(16.67)	

Kenya		1(2.17)
- Netherland	1(2.17)	
2(4.76) Norway		
1(2.17)	- Russia	
2(4.35)	- Scotland	
-	1(2.38) Spain	
1(2.17)	-	
More than two countries	-	
2(4.76) USA		
5(10.87)	14(33.33) Not given	
2(4.35)	4(9.52)	

Italian newspaper published almost identical equal number of science news with content referring to United States and Italy13. National science in the Latin American newspapers found lesser space than scientific results from developed countries14.

Prominence of news

The placement of a news story in a newspaper indicates the importance accorded to the story. News are categorized and placed in specific sections like national, international, science and technology, sports, entertainment, etc. The study revealed a set pattern of placing of the S&T and health related stories in the Hindi newspaper. Over 85% of the stories were printed on the 12th page which is also the last page of the newspaper. Of the remaining, 7% were printed on the 3rd page. The placing shows that the newspaper has a clear preference of placing the S&T and Health related news stories together on a fixed page. Occasionally the stories were placed on the other pages. In case of The Assam Tribune almost equal percentage about 20% of stories were placed on page 6 and 12 followed by 10% on page
5 and 8. Not a single S&T or health related story found space on the first page of Dainik Purvodoy. On the other hand The Assam Tribune published 2 stories on the first page both written by Sivasish Thakur and both involved present day issues. One was on encroachment in the forest and the other on urbanization. To become front page news science stories have to compete against political news.

News Sources and quotation

Overall 63% of the stories had quoted someone. The individuals being quoted included scientists, university faculties, subject matter experts, high level institutional officials etc. Remaining 3% quoted either 2 or 3 people. When compared overall The Assam Tribune had quoted someone in 59% of stories as against 69% of Dainik Purvodoy. On further analysis it was observed that majority of them (97%) had quoted a single source (70% in The Assam Tribune and 90% in Dainik Purvodoy). The remaining 3% had quoted either two or three sources. In order to confer credence and an air of authority to their stories the newspapers tend to quote eminent people and organizations to authenticate the news5. While sources used determine the way issue is framed, often it is in the hands of the journalist to choose the sources16.

Use of news agencies has become a common practice to obtain mostly the news from outside the country on regular basis. Overall only 16 science stories had been sourced from different news agencies/services (Fig. 2) and all of them were from The Assam Tribune. Of the 16 stories Press Trust of India (PTI) contributed maximum (56%). Other sources included Agence France-Presse (AFP), IANS, etc. None of the stories in the Dainik Purvodoy under the study period mentioned any news agency or service provider's name.

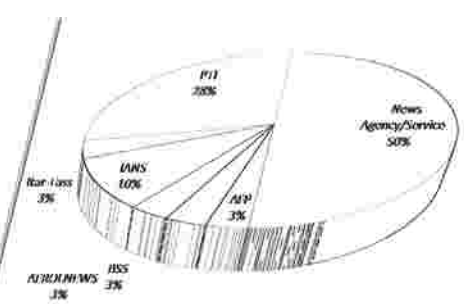

Figure 2. News agency for stories published in The Assam Tribune

Conclusion

Though science is there in every aspect of our life yet the continous lack of not only front page science news but also occupying very little space in the newspaper highlights the fact that science has yet to find favour by the editors as well as journalists and writers if we are to create awareness among the common man. The study highlighted that contribution of subject experts is negligible in regional newspapers. An indepth, comprehensive and long term study is required to analyze the reason behind this.

Allotment of the space for coverage of science news in dailies, be it national, regional or local, depends largely on the mindset of the individual publishing group of such dailies. In such a situation, in the greater interest of the well-being of the society, the government may also think of imposing statutory obligations on the publication groups for increased science coverage. Instead of relying too much on foreign news agencies for domestic science coverage, we have to create our own science news agencies in order to make it more need based and also with a view to avoid hyped coverage. Since there is dearth of studies which focused on the science coverage in Indian print media especially with reference to the regional influences the authors sincerely hope that the study will incite other researchers to take up in depth studies for better understanding of the lacuna in the science dissemination and public understanding.

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214. Information, Communication Technology in Agricultural Research at DIPA Portal

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Abstract. The Indian Council of Agricultural Research is deluged with information through research journals, periodicals, scrolling news on ICAR website, database, etc. The huge volume of information is generated at ICAR research centres, institutes and State Agricultural Universities that is required to be managed and Directorate of Information and Publications of Agriculture (DIPA) does the same work. It collects information and communicates to farmers, scientists, research workers, students etc. The communication system of DIPA has a source of information as research centres, institutes and state agricultural universities which are mainly originator of message; the communication channel i.e. print and electronic media through which message is conveyed; and complete team of scientific-skilled personnel who receive information and convert it into knowledge. Since March 2010 the ICAR has approved Open Access Policy, and all its journals, periodicals, in-house journals, catalogue of books, circulars, etc. in English as well as Hindi are available on icar.org.in.

The present paper deals with the network of existing information resources, together with news services for identified gaps so coordinated as to reinforce and increase the activities of the individual units and thus enables specific categories of users, viz. research oriented workers, farmers, students etc. to receive the information in form of journals, periodicals, in-house journals, etc. to receive the relevant information to their needs and abilities. The paper has discussed Information system and role in DIPA, components of information systems, DIPA portal on ICAR web site, fast communication with the referees and authors through newly developed soft ware under a NAIP project,

'E-publishing and Knowledge System in Agricultural Research'. The advantages of this project include negligible investment by the author; short duration in communication with the referee/author; once accepted manuscript is published in short duration and is also made available on DIPA portal/ICAR web site. Already published contents can be secured by developing digital archives. This project viz., 'E-publishing and Knowledge System in Agricultural Research' has been funded by the NAIP, ICAR for establishing an e-publishing system for the open access of the e-journals/e-periodicals etc. Besides it also provides opportunity to do knowledge management of the experts of the different disciplines viz. Agricultural Sciences, Animal Sciences, Fisheries, etc. Once this project is completed it will bring a revolution in the Agricultural Information Technology.

V

Globalizing & Localizing Science Communication

215. Science Quiz on TV: An Interactive Approach to Promote Science to Elementary School Students

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Abstract. Since 2008, the Ministry of National Education of the Republic of Indonesia has decided to include science as one of the subject of the national level final examination for students, from elementary to senior high school level. Many programs, such as Science Olympiad and Science Festival, have been executed to encourage students to learn science.

This year, a new program has been carried out. DoctoRabbit was assigned by the Ministry of National Education to design and execute an interesting science quiz for elementary school students to be aired on TVRI (the government owned national television). The series of thirteen episodes of the program have been taped and just broadcasted since October 18, 2010.

The duration of the program was 55 minutes, consisted of four main segments, i.e. Science Games, Logical Test, Science Experiment, and Science Challenge. In every episode, there were 100 students from five teams involved as the participants and another 100 students as the audiences. Juries were elected from academicians, celebrities, and practitioners.

Students and teachers were excited with the program. The quiz has broaden the chance for more students to get involve in a science competition, while the chance to join in a Science Olympiad was limited to the best and intelligent students only. The competition was also in a fun environment. The Ministry was satisfactory with the program and planning to continue it next year.

Keywords: Science quiz, TV program, Science for the elementary school students

Introduction

Not many countries regulate a national exam for elementary school students (Year 6). Indonesia is one of very few countries that conduct it since 2008. There are three subjects to be examined: Indonesian Language, Math, and Science. This new regulation has brought pro-cons from educators and public. They who are in favor of the national exam told that the result would be a good data to map the quality of teaching and learning at schools all over Indonesia. But they who are against it told that it is not fair to the students since their final result will be judged only by the six hours exam, rather than the process of their six years of learning.

Whatever the pro-cons said, the reality to the students is they still have to face the national exam and put their effort to pass it. Every year, Year 6 students and their parents are busy with the preparation to make them ready to do the national exam. They take additional courses after school, although their schools have added longer hours for special preparation towards the exam. Many after school courses business arisen to take the opportunity. Consequently, teachers and parents tend to drill the students with all questions and answer exercises to memorize all subjects, without considering whether they understand it. It is a very stressful year for the students, teachers, and parents.

To help students to overcome their stress, educators and the Ministry of National Education should continuously offer several education programs that are fun and interactive for them to learn about the subjects, especially science. Otherwise, students may find science is a boring and difficult subject, and that situation will not supportive to the quality development of science knowledge and skills of the students.

The Important Findings

There were many researches have been conducted on science education for children. One of it was the Cognitive Acceleration through Science Education (CASE) project in UK (Bennet, 2003). The key research findings from that project were as follows:

- By the age of 14, pupils of average ability are unlikely to have developed the intellectual abilities to cope with abstract ideas in science.

- Much of the content of the science curriculum for 14-16-year-olds in the 1970s and 1980s was outside the intellectual grasp of substantial numbers of pupils.
- The CASE project has yielded evidence that a specific program of activities included in science lessons for pupils aged 11 and 12 will lead to improved performance in science, mathematics and English examinations at age 16+.
- Explanations for the effects of CASE vary as to whether the materials enhance certain specific aspects of intellectual development or more general cognitive development.
- There has been debate in the literature over the claims made for CASE and the extent of its effects on pupils' performance.

Besides the above findings, we also know that there are three types of learning, so called "Bloom's taxonomy of Learning Domains" (Bloom, 1956), which are consists of cognitive (knowledge), affective (attitude), and psychomotor (skills).

Science Quiz on TV

Based on the above research findings, especially the statement that the average children less than 14 years old have difficulties in understanding the abstract ideas of science and considering all children learning domains, I proposed the uses of an interactive science quiz on TV to promote science understanding to the elementary school students. Why does the science quiz on TV will help children to understand science? It is just simply because it is fun, entertaining, educating, and broadcasted nationwide. Children will eagerly watch the program without any objection.

Through my company, DoctoRabbit Science Inc., we proposed a concept for the Science Quiz on TV to the Ministry of National Education. It combined all learning domains and make the abstract ideas of science become more concrete or at least more understandable. It is fortunate that the Ministry accepted our proposal and appointed us to execute the program to be aired on TVRI (state owned TV Station). The program has been taped for 13 episodes and just broadcasted since October 18, 2010.

Duration of the quiz was 55 minutes and participated by 100 students from 5 schools (that means 20 students per school). There were 5 juries involved in every episodes, consists of a science educator, a science communicator, a psychologist or an educational expert, celebrity, and an officer from the Ministry of National Education. Content of the quiz was divided to 4 main segments played by different students from each team, such as follows:

Science games

It was a team racing games, played by 10 students per school. An example of the games was The Ampera Bridge (name of a bridge in Palembang – a town in Sumatera Island) where 8 of the team members made a bridge from 4 sticks to help the other 2 team members across 'the river' without falling down. They learned how to balance their body.

Logical test

In this segment, 3 team members would have to answer 4 questions included the reason of their answers after watching a video. To encourage students to answer the reason - regardless they answer is right or wrong, there were no zero scored unless they did not make any reason for their answers.

Science experiment

Other 3 team members were required to make a science experiment as instructed by the juries and make a presentation afterwards. Again, no zero scored for this segment. In fact, this segment score is the highest among all other segments since it needs both motor and presentation skills.

Science challenge

The last 4 team members would take part in this segment. They have to overcome the challenge given. For example, they have to follow a path in a mirror maze by looking through a mirror, without touching the side of the path that sound the alarm. If the alarm was sounded less than a certain number (which is decided by juries), then the successful team would get the highest score.

To make the quiz more attractive, each school was permitted to bring their own supporters or cheerleaders.

Conclusion

This interactive quiz was designed to cope with all aspects of learning domains and make the science ideas more concrete. We have not make any research for the result of this program, but from some interview to the students and teachers participated in this quiz, we found that they were very enthusiastic and enjoy the program.

The Ministry of National Education has also asked us to develop the quiz nationwide for next year. This could be a sign that this program is acceptable and probably right to be an alternative approach to promote science understanding to the elementary school students.

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216. Research Communication in a Young University: Cooperation between the University Library and the Information Office

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Abstract. This paper describes the role of the university and the information office at one of Sweden's young universities. How can the university library and the information office cooperate to support and communicate the research activities Examples of cooperation are given and new ideas presented.

Keywords: Research communication, Shift lectures, Library as a village, Research hub, Research gallery, Research slam sessions

Introduction

Malmo University is very young and has had a strong student focus since it started in 1998. In recent years the research focus at the university has become bigger. Parallel to this, the national governmental research funding has gone through a transition process from broad general funding towards more specific and profiled funding.

These changes have encouraged Malmö University to take a serious and close look at its research activities. Some of the principal parameters measuring research activities are the number of scientific, peer-reviewed articles and citations, and the university's ability and willingness to share and spread research results to the public.

Research Profile Malmo University

Research and postgraduate education is carried out throughout the whole University, often as partnerships between different fields. The strategy of research at Malmö University is collected in eight profiles, some of them multi-disciplinary:

- New Media
- Migration
- Urban Studies
- Sports in Transition
- Science of Education
- Oral Health
- Biological Interfaces
- Health and Social Conditions in Terms of a Life Cycle

Malmö University's Multi-Disciplinary Research Institutes

- Biofilms–Research Centre for Biointerfaces
- Research by Profession
- Malmö Institute for Studies of Migration, Diversity and Welfare
- Centre for Applied Worklife Science
- MEDEA Collaborative Media Initiative

Short Facts about Research at Malmö University (2009)

- Turnover: 28,5 million $/year
- 65 full professors
- 218 PHD-students
- 238 articles in peer-reviewed international journals

Film: http://vimeo.com/15022964

The role of the University Library and the Information Office

The key role for a University Library and for an Information Office is – of course – to support and serve the core activities of education and research. Any university library and any information office must reflect the university in which they operate.

How do we–the University Library and the Information Office–reflect Malmo University, a 12-year old hybrid university in Sweden's third largest city?

The Library as a Village

The university library is open to the public and quite a few citizens of Malmö are registered as users of the library and have acquired a library card.

Malmo University Library has for several years worked within the frame "The Library as a Village".

Every village has exhibition areas, advertising pillars, billboards, open lectures with comfortable seating facilities, squares, open areas, silent areas, noisy areas, a school, a church, a café, a gallery, a graffiti wall, a playground, studios, trees, concerts, parties, receptions, dinners–and so does Malmo University Library.

Together with the Information Office at the university we try to get as much as possible out of the library. The space, the exhibition areas, the advertising pillars, the billboards and the open lectures – called Shift Lectures – all in order to spread and to share research at the university.

An example: Every month we have a public audience of appr 100-200 citizens listening to research findings and debates on current issues at open and renowned lectures in the library. The lectures are broadcast on our main webpage in real time – a very effective way to reach out.

The Research Hub

Another interesting new feature at the university is The Research Hub. The Hub was created in a common project between the university library and the information office. It allows you to find descriptions of the university's research and researchers at a glance in one location. Originally made for the media, it is also very useful for anyone interested in finding out more about research at the university. The hub automatically gathers data from the Staff registry, from the Institutional Repository MUEP (Malmö University Electronic Publishing), from the description of research programmes and profiles, and from social networks like Twitter and Facebook if wanted.

Coming up http://forskarnav.mah.se

In the pipeline we have several ideas on how to develop our cooperation and the library as a village concept. Some of these ideas we are working with right now, some of them will be realised soon. The sky is the limit!

- Monitor and photos (portraits) at the entrance of the library, exposing Malmo University's research profiles. The descriptions of the profiles is made by the Information Department and these descriptions may alternate with an RSS-flow from our institutional repository currently showing the most recent theses
- Establishing a "Research Gallery" equipped with monitors, headsets, poster area and projectors to present current research and results and combine it with small presentations by the researchers themselves
- Research Slam sessions. Inspired by Poetry Slam, at Research Slam sessions the researchers are asked to make their own free interpretation of a topic, and the audience puts their vote to the best performance
- Cooperating with the Information Office and the regional TV channel, offering the library as an arena for TV spots and interviews about current research at the university
- Together with the Information Department establishing a mobile hotspot Xpo Malmo University. The hotspot makes it easy to move the research communication out of the university buildings

We are happy to receive your input and comments on our ideas about the library as a village and the cooperation between the University Library and the Information Office. Please don't hesitate to contact us.

217. Optimizing a Context-Based Science Communication Course for Science PhD Students

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Abstract. These days scientists are increasingly called upon to communicate about their work and its social and economic relevance to a variety of different target groups and stakeholders. To support this challenge, in 2007 a science communication course of four days within a month with a focus on engagement was developed at the Faculty of Science of Utrecht University, intended for PhD students with a special interest in public communication.

Over the past three years about 40 students have participated in 7 editions of the course, which comes in a Dutch- and an English language version. The course links theory of science communication to practice by facilitating participants to present their own research to real live audiences (i.e., context-based) with the intention of engaging the public and fostering dialogue.

This paper focuses on a critical retrospect of the course based on empirical data and various theoretical perspectives so as to further improve the course. The course aims to establish a change in mindset of the students: 'from telling them what you know, to telling the public what they want to know.' So the course is strongly focused on public engagement and based on the view of situated learning. Learning by doing is crucial in the field of communication, so the PhD students communicate about their own research in 'real life' situations, such as writing for publication on the web, or presenting for an actual school class. In addition peer feedback plays an import role. Participants learn a lot from and with each other through feedback sessions.

In collecting and analysing the data sets, which include observational notes, student evaluations and student performance, three different levels are distinguished: the intended level (course objectives), the operational level (actual teaching and learning process), and the attained level (learning experiences and outcomes of students). Differences in learning style, attitude towards science communication, domain specific background, and cultural background are explored in search of criteria for fine-tuning course in terms of format and for different student types.

Results show that aiming for two concrete products – an oral presentation and an article for a general audience – as the outcome of the course is a feasible goal. The quality level of the product is strongly related though to a person's language proficiency. In addition the educational approach of 'learning by doing' combined with 'social learning' is a suitable approach for such a science communication course for PhD students, on the condition that the students' apprehension for the unfamiliar approach in teaching the course is overcome in the first day of the course.

Introduction

Four years ago at Utrecht University a science communication course for science PhD students was developed with a focus on engagement. This was in response to the latest developments in the science communication field where a paradigm shift is being seen from the 'classical' or 'cognitive deficit model' to the 'contextual model' (Wynne, 1991). This means that the public more and more becomes an active partner in the communication process and is not perceived solely as a 'receiver', as is the case in the so called 'deficit model'.

In addition (young) scientists feel an increased demand to communicate about their work and its social and economic relevance to a variety of different target groups and stakeholders. These days the EU only accepts research proposals in their 7th Framework Programme for Research and Technological Development, if a paragraph about the societal impact of the research is included. So research should have added value. The results should be useful - in some way or other - to society, and citizens should get to know about it. So PhD students have to train their communication skills and should be able to set out in simple terms why their research project is worth pursuing.

At the same time governments in Europe and elsewhere around the world see the added value of 'setting up a dialogue' with the public. The antagonism against genetically modified foods and 'socio-scientific' issues such as mad cow disease and the dioxin crisis ask for public involvement in decision-making processes. Science has become so complex and has such a global reach that many politicians feel decision-making in this realm cannot be left to the scientific community alone. Citizens should have their say about future developments in, for instance, nanotechnology.

That's why within science communication Dutch government wants scientists to enter more into dialogue

(Commissie Esmeijer, 2003). Two-way communication is emphasized: scientists inform citizens and citizens inform scientists. Regional initiatives are sought after. An explicit mention is made of direct contact between scientists and high school students.

So the new science communication course needed to have an emphasis on 'engagement' and it should have added value to what was already available. First of all there were the books (for instance: A field guide for science writers, Blum et al, 2005) and websites with heuristics that are available on the issue. In addition short one-day courses on science communication with the public were available for PhD students, and Utrecht University offered several courses on academic communication skills (peer-to-peer communication). This meant the course had to fill the following niche: a more extensive course focused on communication with the general public and focused on 'real life' experience and the generation of concrete products.

As this course was developed by the Freudenthal Institute for science and mathematics education (FIsme) of Utrecht University, the following commonly held notions within the institute were used as a guideline for design criteria: engagement, concern-based, situated learning (hence also context-based), experiential learning, and the teacher is 'facilitator'. These notions are derived from constructivist views on learning. These views emphasise the active role of the learner in building understanding and making sense of information (Woolfolk, 2008: 411). (For a further elaboration of the notions see section 3).

Initially in the development process of the course these educational notions were taken as 'given' and now after four years, seven courses and 45 participants in total, it's time for a critical retrospect on the implementation of the notions in the course using goal-based criteria and an evaluation of the learning objectives of the course. Empirical data and theoretical perspectives will be used to answer the central research question in this study: How feasible and effective is the context – based science communication course for science PhD students?

Based on the outcome of the study suggestions will be formulated to optimize the course itself, and more general recommendations will be given for training and courses in science communication.

The Original Set-Up of the Course

In 2007 the science communication course was first developed for a total of 8 PhD students, ideally with different science backgrounds to stimulate the interactive learning process. During the course participants learned the basic principles that govern science communication to a general audience. They also had to implement this knowledge in two concrete communication products about their own research: a short interactive presentation and a popular scientific article. For a more elaborate overview of the educational design of the course see appendix 1.

The course participants worked together as a learning community. They learned a lot from and together with each other through feedback sessions. As a consequence the role of the teacher was that of 'facilitator' of the learning process and not of 'instructor'. On the basis of science commu¬nication theory, personal experience, reflection, and analysis of a range of different example cases, PhD students developed their own specific communication products.

The course sessions themselves took up three full and two half days during one month. During the same month, PhD students had to set aside a minimum of four more days to prepare and revise their presentation and article. As communicating with the public is something one mainly learns by actually doing it, the course strongly focused on 'real life experience'. So in addition to a trial-run presentation within the group, the final presen¬tation was held at a public event for a general audience at the local Utrecht University Museum. The popular article was written with the aim to have it published.

For the first version of the course five learning objectives were formulated. At the end of the science communication course for science PhD students the course participant should be able to:

- switch his/her mindset from 'telling them what you know, to telling the public what they want to know'
- practice 'dialogue' rather than 'monologue' (i.e. engagement) with the publicdevelop and carry out a public presentation and write a popular scientific article based on basic communication principles
- assess the quality of communication products, both his / her own and those of others
- reflect in groups supported by giving and receiving feedback

For the first version of the course the PhD students were asked to participate by the teacher through personal invitation, using her personal network. The courses that followed were accompanied by a small advertisement campaign. Four months before the start of a course, the course was promoted by a mention in the newsletter of the science faculty and in the Utrecht University PhD newsletter. In addition a letter was sent to all scientific directors of the research groups in (veterinary) science and medicine, kindly requesting them to bring the course to the attention of the PhDs in their group (see appendix 2 for the accompanying course leaflet). The argument given in the letter and in the course leaflet to promote PhD students to participate in the course, was the increased demand on scientists these days to communicate about their work and its social and economic relevance to a variety of different target groups and stakeholders.

Elaboration of the theoretical framework

The new science communication course had to be developed with a focus on ‘engagement in communication and setting up a dialogue’. This was in response to the latest developments in the science communication field where a paradigm shift is being seen from ‘transmission’ (the ‘deficit’) to ‘transaction’ (the ‘contextual model’) (Wynne, 1991). In this shift the public is increasingly being viewed as an active and equal partner in the communication process. During dialogue knowledge is being co-constructed by both parties in the communication process.

When ‘engagement’ is the central focus of the course and when one wants to gain credibility, one has to ‘practice what you preach’, also in the educational design of the course. So the learning individual should be seen as active and equal and as a partner in the co-construction of knowledge. Social constructivist views on learning embody these views.

Constructivism views learning as more than receiving and processing information transmitted by teachers or texts. Rather, learning is the active and personal construction of knowledge and acquiring skills (De Kock, Sleegers and Voeten, 2004). And the outcomes of this process of personal knowledge construction and acquiring skills are often tested against the experience, knowledge and competencies of others. So meanings are negotiated and co-constructed. Therefore social constructivists see learning as increasing our abilities to participate with others in activities that are meaningful in the culture (Windschitl, 2002).

So from the perspective of (social) constructivist learning theory the notions, that were taken as a ‘given’ for the development of the course, will be further elaborated on.

1. Engagement: ‘fostering dialogue with the public’ is a central idea in the course. This means co-construction of knowledge is important. The learning theory of (social) constructivism fits well with such principles.
2. Concern-based: Learning is the active and personal construction of knowledge and acquiring skills. Each learner has unique needs and a unique background. So in this course there should be enough space for each participant to ‘tailor’ the course to his or her needs. To a certain degree the course can be and should be ‘personalized’.
3. Situated learning: Situated learning is based on the idea that skills and knowledge are tied to the situation in which they are learned and difficult to apply in new settings (Woolfolk, 2008: 414). They are context-based. So science communication skills should be learned in ‘real-life’ situations and learned in a ‘cultural setting’ that is familiar to the science PhD students.
4. Experiential learning: Constructivism is associated with ‘learning by doing’ (Kolb, 1984), by participants being actively involved in the learning process and by reflecting on that process. This is what experiential learning is focusing on and this way of learning is integrated in the set-up of the course.
5. Teacher is ‘facilitator’: Social constructivism focuses on how individuals themselves make sense of information and generate knowledge in interaction with the social environment they are in. They should learn to discover principles, concepts and facts for themselves. Therefore the course teacher should facilitate that process, and steer away from the ‘instructor’ role. Participants should become ‘owners’ of their own learning process. This is the best way to ensure lifelong learning.

For a critical retrospect on the implementation of these five notions in the course and an evaluation of the learning objectives of the course, the following evaluative questions can be formulated:

1. Was the course set up in such a way that it did focus on ‘engagement’? Can at the end of the course a participant switch his/her mindset from ‘telling them what you know, to telling the public what they want to know’? Is at the end of the course a participant able to practice ‘dialogue’ rather than ‘monologue’ (i.e. engagement) with the public?
2. Did the course have ‘space’ to adapt the course to a participant’s needs? Did the participants use this ‘space’?
3. How is ‘situated learning’ integrated in the course? How is situated learning perceived by the participants? Is situated learning a good approach for a course like this one?
4. In what way does the course offer room for experiential learning? Did the participants work well through experiential learning? Did peer feedback work?
5. How is the teacher’s role shaped? How did the participants perceive the teacher’s role? Did the teacher stick to his / her ‘facilitator’ role?

6. To what extent were the learning objectives met?

As the course is based on notions derived from social constructivism, social interactions and cultural context are important. Therefore the following aspects of the population of PhD students will be clarified in the respondents' section of this article: cultural background, gender, and science background.

Respondents, data collection and analysis

Respondents

The respondents of this study are both course teachers - first author (6 courses) and Robert Kerst (1 course) - and the 45 PhD students who participated in the science communication courses. Liesbeth de Bakker is science communication lecturer at Utrecht University and developer of the science communication course. Robert Kerst is science communication officer of the science faculty of Utrecht University. Information about the PhD students regarding their cultural background, gender and science background was derived from the registration forms for the course. In total over a time span of four years seven science communication courses were held: four Dutch language versions and three English language versions. In total 45 PhD students participated: 28 to a Dutch language version and 17 to an English language version of the course. (Sixty percent female, fourty percent male).

For an overview of the cultural background of the participants see table 1. Table 2 gives an overview of the science background of the participants.

Table 1. Overview of cultural background of participants

Cultural background	No. of participants
Dutch	35
Asian	6
European	2
North American	1
African	1

Table 2. Overview of the science background of the participants

Science background	No. of participants
Pharmaceutical science	10
(Bio) medical science	10
Physics	9
Chemistry	5
Biology	4
Geology	3
Astronomy	2
Veterinary science	2

Data collection and analysis

By using a typology used in curriculum studies (Goodlad, 1979) the course was studied on three different curriculum levels: the intended (course objectives), the operational (actual teaching and learning process), and the attained curriculum (learning experiences and outcomes of students). For an overview of the data sources used for analysis of the science communication course on the three different curriculum levels see table 3.

Table 3. Data sources and levels of analysis

	Curriculum levels		
Data sources	Intended	Operational	Attained
Course documents	√		
Observational notes		√	
Student evaluations			√
Student products			√

The intended curriculum was uncovered by content analysis of relevant documents, such as the original documentation on the course (De Bakker, 2007). The operational curriculum was studied on the basis of observational notes on the actual teaching made by the course teachers. Finally, through student evaluations (see appendix 3 for the evaluation form) and assessment of student performance and products by the teacher, the attained curriculum could be determined.

Results

In an attempt to answer the main research question of this study - How feasible and effective is the context –based science communication course for science PhD students? – first of all the evaluative questions as formulated in section 3 will be answered, and where necessary and relevant for the three different curriculum levels: the intended, operational and attained curriculum.

Engagement

Intended curriculum: Was the course set up in such a way that it did focus on 'engagement'?

From the original documentation of the course it appears that on the first course day the focus lies on 'from telling them what you know, to telling the public what they want to know.' The public should become the starting point in communication. And the public should become perceived as a serious partner in communication – a partner in dialogue. In the two assignments (the presentation and the written article) this perspective of 'putting your audience central' is emphasized, so interactivity in the presentations is strongly emphasized and promoted. An exercise such as writing a popular scientific article though has very little scope for interactivity or 'dialogue'.

Operational & attained curriculum: Can a participant switch his/her mindset from 'telling them what you know, to telling the public what they want to know'?

At the start of the course the attitude towards science communication of the PhD students was judged by the remarks they made on the first day of the course. It was clear that all of them perceived science communication from a 'classical' perspective. They were the 'sender' and the public the 'receiver'. So they worked within the settings of the 'deficit model'. Remarks like: "I want to tell the public about science because they know so little about it and unknown makes unloved", were often heard when the students spoke about their motives for wanting to be involved in science communication. The contextual model where the scientists co-construct knowledge with the public was still far from their minds.

Gradually, as the science communication course progressed, it became clear from participants' remarks and their written evaluation reports that most of them made a switch in thinking. In developing their products their first question often became: what would the audience like to know? As one Dutch female participant with a pharmaceutical science background put it: "A strong point of the course is that it forces you to step out of your scientific role and to put yourself into the shoes of the public." As a consequence the participants' communication products are (to a large extent) accessible and interesting for a lay audience. Still, a strong focus on communicating plain facts and ideas remains. The notion that it might be possible or desirable to generate knowledge in dialogue with a public is something that's too far fetched for the participants.

Attained curriculum: Is at the end of the course a participant able to practice 'dialogue' rather than 'monologue' (i.e. engagement) with the public? Even though the PhD students were explicitly invited to interact with their public during their presentation, it did not result into the desired attained level of the course. Most of the PhD students (about 50%) only managed to ask the public one or more questions during their presentation. About 20% of them really did something interactive with the public but these efforts did not yet lead to something that resembled a 'mini-dialogue'. The rest of the course participants chose not to directly involve the public and only allow questions at the end. One Dutch male participant with a medical background remarked: "I don't like it, to ask the public questions mid-way the presentation. It disrupts my own story and it makes me nervous because you never know what answers they come up with." About a quarter of the course participants felt the same way.

Concern-based

Intended curriculum: Did the course have 'space' to adapt the course to a participant's needs? Even though the general set up of the course was fixed, e.g. five sessions over the course of a month in which two communication products had to be made: a presentation and a popular scientific article, the separate course sessions left plenty of room for the participants to address specific issues that they were concerned about. On the first course day all participants were asked for their general personal learning aims and the teacher would keep these aims in mind for each individual during the course. In addition, if one participant would develop a special interest in a specific aspect of science communication, additional literature and guidance would be provided for the PhD student. ***Operational curriculum:*** Did the participants use the 'space' to adapt the course to their own needs?

Only very few students tailored parts of the course to their own needs. When asked for their general learning aims at the start of the course, most of them expressed very general aims. "Learn to how to 'translate' a scientific message to one that can be understood by the public" was the most frequently uttered learning aim (15 times). Some participants were more focused on improving their presentation skills (8 times), others their writing skills (4 times). So the course in general provided the information and the training of skills that were sought after. Hence the participants felt little need to use the space to adapt the course to their own needs.

Only two PhD students (one male and one female, both Dutch and with a medical background) explicitly asked to write a press release about their work as they had almost finished their PhDs and wanted to generate media attention for their work. This was facilitated by extra literature and more specific feedback.

There also was a female North American PhD student from veterinary science who felt she needed more assistance when it came to 'risk communication', so she received extra literature on the matter. This is of course an 'academic learning' approach but due to time constraints there was no possibility to deal with the matter in a more constructivist manner. Through self-study the PhD student used some of the information in the development of her presentation and written article.

From the student evaluations it emerged that most participants agree they've now got the 'basic' knowledge and skills for science communication, but still they feel there's a lot to learn. About 10% of participants feel they would have wanted more in-depth knowledge about different target groups and assignments for different target groups (so not only adults or high school students).

Situated learning

Intended curriculum: How is 'situated learning' integrated in the course? The starting point of this course is the authentic practice of the PhD students themselves. This means the course is based in the context of their own PhD research. Part of that context and practice is communication about their work, not only peer-to-peer, but also to other target groups such as the general public, or the funding agency. To foster the interactive learning process ideally eight participants from different science backgrounds are selected for the course.

In addition, the course's practical tasks are set in a 'real life' situation. The participants talk to a journalist about their research project, they present their research to a lay audience on a public event, and they write their popular scientific article with the aim to really publicize it, i.e. on a popular science website or the news magazine of Utrecht University.

Such 'real life' assignments take time. So 32 hours of contact time with the group were scheduled. This included ample time for feedback sessions to critically assess the products mid-way and to give constructive feedback. In addition each participant individually had to reserve a similar amount of time to make and revise the products at home.

Operational curriculum: How is situated learning perceived by the participants?

It's positively perceived. Many PhDs expressed they felt connected, part of a group with lots in common. This sentiment was most strongly experienced by the PhD students with a non-Dutch nationality. One male PhD student from African origin and with a background in chemistry remarked: "It's great to finally meet PhD students from a different science background and to find out we all struggle with the same problems, like publication deadlines and difficulties in explaining to family and friends what exactly it is you are doing."

In addition all PhD students were very happy to communicate about their own research and their own results if there was no risk in jeopardizing their official academic publications. Some students followed the course very early in their PhD track and they therefore did not have any results to report about. In that case they communicated about the social relevance of their research. One male Dutch PhD student with a geology background who did the course in the first half year of this PhD project remarked: "It's interesting to find that by thinking in the science communication course about the social relevance of my research project, I now also get a better grip on the research question of my PhD project".

Attained curriculum: Is situated learning a good approach for a course like this one?

Based on the reactions on the student evaluation forms the answer is yes. Many of the assignments were as 'life-like' as possible and this scored high marks. The workshop in which the PhD students met up with a professional journalist who asked them all sorts of general questions about their research was a real eye-opener to the participants. Immediately they got a feel for their public and the 'low' or general level of interest the general public has in their PhD project. One Dutch female participant with a pharmaceutical science background remarked: "I was really surprised that a journalist expects you to have some facts and figures ready about the disease or illness you're studying just an aspect from."

In addition, the fact that the presentation and the writing exercise were set in a 'real life' situation was earmarked as the highlight of the course. Interestingly though, when it came to publication of the popular scientific articles which were written for the course, very few ended up in the public domain. Only six articles out of 45 were finally published: two on a popular science website for high school students (http://www.kennislink.nl/ search for articles by Vasco Verlaan and Paul Leclercq), two as a hand out with the presentation which was held within the framework of the course, one in the Utrecht University newspaper (www.dub.uu.nl) and one as a press release.

The reason that the other 39 articles weren't publicized was twofold. Often the PhD students did not have concrete results yet, so the texts didn't meet the requirements of the publisher. And occasionally the PhD students themselves decided they weren't ready or willing to publicize their text just yet. One Dutch female participant with a physics background wrote in her evaluation: "The time to write an article is simply too short to be happy with the final product. I need more time to think things over and process it all. I guess in another month a final rewritten version will come out."

Experiential learning

Intended curriculum: In what way does the course offer room for experiential learning? In experiential learning one makes meaning from direct experience. So the course was organised in such a way that the participants had to develop their own heuristics for science communication through dedicated exercises and experiences. The PhDs are put in 'real life' communication situations and afterwards they are stimulated to reflect on their experiences. This process is supported by the fact that the course participants are divided into two teams. Every course session these teams help each other in feedback sessions. They are taught to give constructive criticism on each other's presentations and popular articles. And at the end all participants are asked to actively reflect on their own performance and communication products by answering a short questionnaire (see appendix 4).

The feedback and reflection moments that were built into the course were aimed at a group size of eight participants from different science backgrounds. However, often less than eight PhD students registered for a course, so the ideal mix could not be established. Only two courses had a good mix. Three courses had 50% of candidates with the same science background (biology and astronomy), so the mix was less than ideal. And in two courses there were more than 50% candidates with the same science background (medical and pharmaceutical science) but due to a lack of participants that was the best that could be achieved.

Operational curriculum: Did the course participants work well through experiential learning? Did peer feedback work?

Even though the course was set up in such a way that the participants had to develop their own heuristics for science communication through dedicated exercises and experiences, it soon appeared there was too little time and support for a full implementation of this approach. One male Dutch participant with a physics background said: "It's all very nice to have to talk everything through with the group but I'd rather have the teacher tell us what to do and how to do it best." So in the first course the participants made a strong plea for a reader with science communication literature and clear handouts with heuristics on the basis of which they could start developing their products. Only then they were willing to work with and learn from each other in peer feedback sessions.

Once started these peer feedback sessions worked well and in general it was thought that the process went in a constructive manner. Occasionally though some PhD students felt that their fellow students focused too much on the detail in the articles and in the presentations and not enough on the overall structure and approach to the communication products. In an attempt to steer the feedback process more into the right direction, special feedback sheets were made (see appendix 5). Another interesting observation was that 5 of the 6 participants with an Asian background had to get used to giving and receiving direct constructive criticism but after two course days they usually lost most of their reservations.

Teacher is 'facilitator'

Intended curriculum: How is the teacher's role shaped?

During the course the teacher takes on a facilitating rather than an instructing role. The participants themselves have to find answers to questions through discussion or feedback sessions. The teacher guides this process and tries to avoid giving direct answers. Within communication there are few black and white rules. Every course participant should find a way of communication, which suits him or her best and the teacher aims to facilitate this process, rather than to steer it into a particular direction.

Operational curriculum: How did the participants perceive the teacher's role? During the first course it became clear that mainly the two participants with a physics background had difficulty with the constructivist approach to learning that was applied in the course. They felt a need to have clear guidance from the teacher and asked for a 'instructing' role rather than a 'facilitating' role. The male participant with the physics background told the teacher: "You're the professional, you tell me what to do. I don't think it's a good approach to figure it all out for ourselves in discussions and feedback sessions." Later on his stance changed but only after he'd seen the teacher facilitate the exercise with a professional journalist interviewing some of the course participants. It was an exercise he'd appreciated a lot and had learned a lot from. He'd come to realize that there are other ways to learn than just straight from a teacher or a textbook.

Operational & attained level: Did the teacher stick to his / her 'facilitator' role? The teachers had to grow in their roles as 'facilitators'. Both are used to the 'teacher' role and often they were too prone to give the 'right' answer or to come up with a ready made list of heuristics relevant for science communication. When it also appeared that the participants, certainly at the beginning of the course, preferred the 'teacher' approach, a decision was made to start the course in the 'teacher' modus but to change the approach when facilitating the production process of the two communication products. This intermediate model appeared to be working well both for the teachers as well as the course participants.

Learning objectives

Attained curriculum: To what extent were the learning objectives met?

The first two learning objectives have been discussed earlier under the heading 'engagement' as these two learning aims are directly connected to that notion. The other three learning objectives about developing the products on the basis of basic communication principles, assessment of quality of product, and the capability to reflect, will be discussed below.

When looking at the final products of the participants of the course the question 'whether the participant can develop a product on the basis of basic communication principles' can only be indirectly answered through the quality of their products. In all instances the final presentations were of sufficient quality and so were the written texts. However in 4 of 45 cases the PhD student had to carry out another rewrite of the final version before it was assessed as 'adequate'. One important aspect in judging whether a product was of 'adequate' quality was, whether or not the presentation or article was clearly of interest to a lay audience and understandable for them. And in some cases the text still looked like it was written for a fellow researcher. In other instances the structure still was unclear.

It's interesting to note that when the overall quality of texts is compared, a clear distinction can be drawn between texts which were above average quality and texts which were below average quality. Those above average quality were always written by people writing in their native tongue and those below average quality were written in English by people to whom English is their second language. So it seems language proficiency is related to the quality of a PhD students' product. This relationship also emerged when looking at the quality of the presentations.

When it comes to the assessment of products and reflection on the process and products, it became clear during the course that all course participants were able and willing to judge the quality of their other team members' products. In addition, from the students' self reflection sheets a clear sense of weak and strong points in their own presentation emerged. Many of them remarked that at the end of the course they felt they had made products that were better than before but that these products still could be improved on. "Science communication is something learned by doing it a lot", one Dutch female PhD student with a medical background remarked. "Practice makes perfect."

Conclusion and Discussion

Based on the results as described in the previous section it is now possible to answer the main question of this study as mentioned in the introduction:

How feasible and effective is the context – based science communication course for science PhD students?

Feasible

At the end of the course all participants had produced both a presentation and a popular scientific article of adequate quality. So despite the language problems some PhD students had to overcome, all of them clearly had put their target audience central in their thinking and products.

Crucial factors when it comes to 'feasibility' are: enough time, constructive feedback and 'real' assignments. In terms of time, one should allow five course sessions over the course of a month, with a total of 32 hours. The PhD students should at least dedicate the same amount of time for 'home work', i.e. making the presentation and the article.

Peer feedback and feedback from the teacher are crucial in improving the products. By bouncing ideas off on other PhDs with a different science background it becomes possible to check whether your products are understandable and of interest.

Finally, working towards a presentation on a public event with a real lay audience is the ultimate stimulus to perform well and on time. There's a real feeling of urgency and it's seen as a real 'deadline'. It would be good to organise some sort of a similar stimulus for the writing exercise. This is lacking at the moment.

Effective

When it comes to reaching the learning objectives of the course, they are only partly met. The practical part of the course - making the products and assessing quality of the products and reflecting on the process and the products - can be termed effective.

However, in terms of 'engagement' the course is much less effective. Most of the participants now do mention in their reflection or evaluation that they are aware that they should put the public central in their thinking and products. This change in mindset though is only present in their products in the sense that they are (to a large extent) accessible and interesting for a lay audience. However, taking this train of thought further and opening oneself up to a dialogue with the public and getting into 'real engagement' with the public and the co-construction of knowledge, is still far off.

The answers to feasibility and effectiveness of the course are given with respect to a course that has undergone the following changes on the basis of the student evaluations in the past four years:

1. A reader of modest size was made to accompany the course
2. Teacher becomes a mix of 'instructor' and 'facilitator'
3. Instruction sheets were made to facilitate and focus the feedback process

It's interesting to note that all these three aspects veer away from a pure constructivist approach to learning. And they were made to accommodate the PhD students that participated in the course. If a teacher wants to 'practice what he/she preaches' he/she needs to put the students' needs central in the development of the course. In this case it appeared that the science PhD students were often only used to academic learning: receiving and processing information transmitted by teachers or texts. Situated and experiential learning is therefore totally new to them. That's why it was decided to start the course in a more 'academic' fashion and gradually introduce the situated and experiential learning approach. In practice this meant that the transfer of the 'theory', i.e. the heuristics for communication, was taught in an academic way and the production of the products was supported by situated and experiential learning. This also suited the teachers as they are also used to academic learning and were still growing in their roles as 'facilitators'.

As a consequence the course has become 'feasible' as it fits better with the students' and teachers' needs but at the same time it 'waters down' the situated learning approach. It is therefore no surprise that the ultimate goals of 'dialogue' and 'co-construction of knowledge' are far from being reached.

Is this a problem? In hindsight one has to say, no. It can be concluded that the course as it is held now fits the PhD students' needs. Improving their communication skills with presentation and writing assignments that are examples of more 'classical forms' of communication, focused on transmission rather than on transaction, are just what the participants need at the moment. They are not 'up' to transaction just yet, but the first step in terms of awareness raising on the issue of engagement has been made.

So the course should not stray from its focus on 'engagement'. In both public communication and education it's a goal worth striving towards. As this notion of 'engagement' becomes more well known in the academic world, and if learning in academia slowly but surely - partly - undergoes a change towards situated learning, then maybe in 10 or 20 years' time the PhD students then may well be up to whole-hearted 'engagement' with the public.

Implications for Educational Practice

1 Based on this critical retrospective the following suggestions can be made for the context-based science communication course for science PhD students (these suggestions aim to both keep the PhD students' needs in mind while at the same time work towards reinforcement of the social constructivist character of the course):

1. Just like the presentation exercise the writing exercise should be made for an actual target audience who would also give (direct) feedback. Bring the target audience into the course sessions. Or, as an alternative, a professional journalist could participate and give feedback on the articles. This would give the writing exercise just as much urgency as the presentation exercise. At the moment this is lacking.
2. Currently the social constructivist foundation on which the course is built is not emphasised, let alone mentioned. This should change. As the group thinks about a changing society and the consequences for communication (from transmission to transaction), one should immediately link through to the consequences for education.
3. More participants from different science backgrounds are needed. At the moment less than 1% of all science PhD students of the faculty of Science at Utrecht University participates per year. Apparently the course leaflet is not powerful enough in emphasizing the value of adequate science communication skills. Maybe focusing on the value of better public communication skills for grant proposals should be emphasized as well. Another suggestion might be to try and invite the supervisors of the PhD students to follow the course themselves. This way they can personally experience the relevance and importance of the course for their PhD students and facilitate and enthuse their PhD students for the science communication course. Or, last but not least, ex participants of the course who have made a mind switch and have become enthusiastic, could be asked to bring the course to the attention of their peers.

More in general the following recommendations can be made for science communication training and courses:

1. A focus on 'engagement' as a starting point for a science communication course is a good one but one has to realise that most people are not ready yet for 'dialogue' and the 'co-construction of knowledge'. Therefore adapt the course to your participants' needs and see 'engagement' as the ultimate goal the group is working towards.
2. As communication is learned mainly by doing it, situated and experiential learning is the ideal basis for a communication course. Allow enough time for feedback sessions, reflection and the production and revision of the actual concrete communication products.
3. Ideally the teacher should be a 'facilitator' but the teacher can only take up this role once the students have embraced the idea of situated and experiential learning. Therefore, make sure that in the first day of the course the educational set-up of the course is explained and that the teacher gains credibility through establishing him- or herself as a professional in the science communication field.
4. Try to work from 'real-life' experiences as much as possible. Establish at certain times in the course contact between the course participants and their target audience of preference.
5. (Peer) feedback and reflection are crucial in the learning process, but such things don't come naturally to many of the course participants, so make a point of actively asking them to engage and give them enough support during this process.

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Appendix 1

Educational design
for the context-based science communication course
for science PhD students
(brief English language summary of the original course documentation in Dutch)

drs. Liesbeth de Bakker
FIsme
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May 2007

The science communication course is developed for a total of 8 PhD students, ideally with different science backgrounds to stimulate the interactive learning process. During the course participants learn the basic principles that govern science communication to a general audience. They have to implement this knowledge in two concrete communication products about their own research: a short interactive 10-minute presentation and a popular scientific article of about 800 words.

The course sessions themselves take up three full and two half days during one month. During the same month, PhD students have to set aside a minimum of four more days to prepare and revise their presentation and article.

To foster a good learning process several times the full cycle of experiential learning has to be completed. This learning cycle exists of the following phases: concrete experience (CE) >> observation and reflection (OR) >> formation of abstract knowledge (FAK) >> active application of knowledge (AAK). Through AAK one immediately ends up again at the beginning of the learning cycle: phase CE. Through repeated cycles a course participant gradually grows towards the fulfillment of the learning objectives and the development of relevant knowledge and competencies.

For each day of the course the learning activities will be described and the learning phases (CE / OR / FAK / AAK) will be included.

Day 1: "Focus on target audience" Morning session: introduction of the course (CE); getting to know each other and each other's research (CE / OR / FAK / AAK); identification of aspects in th research that are difficult to explain to each other (OR); search for possible solutions (FAK); communication theory (FAK).

Afternoon session: all participants formulate their 'research in a nutshell' (AAK / CE); peer feedback instruction (FAK); peer feedback session on 'research in a nutshell' texts (OR / FAK); formulation of a heuristic for proper science communication with a lay audience (FAK); professional journalist interviews participants about their work (CE / OR / FAK / AAK)

Homework: rewrite your 'research in a nutshell' text and develop plans for your written article and your presentation for a general audience.

Day 2: "Focus on product"
Morning session: Short theoretical introduction on presentation skills (FAK); analysis of a presentation of a scientist on DVD (CE / OR / FAK); peer feedback on initial presentation plans (AAK / CE / OR / FAK)

Afternoon session: Short theoretical introduction on writing skills (FAK); analysis of two popular science articles (CE / OR / FAK); peer feedback on rewritten 'research in a nutshell' texts and initial plans for article (AAK / CE / OR / FAK)

Homework: Group 1 writes their first version of their article. Group 2 prepares their first version of their presentation.

Day 3: Product analysis I

Morning session: Peer feedback session on trial-run presentations (CE / OR / FAK / AAK); peer feedback session on first versions of articles (CE / OR / FAK / AAK)

Afternoon session: More theory on writing and presentation skills (FAK); metaphor exercise aimed at finding new ways of explaining difficult concepts in research (CE / AK / FAK / AAK)

Homework: Group 2 writes their first version of their article. Group 1 prepares their first version of their presentation.

Day 4: Product analysis II

Morning session: Peer feedback session on trial-run presentations (CE / OR / FAK / AAK); peer feedback session on first versions of articles (CE / OR / FAK / AAK)

Homework: Everybody works on their final versions of their presentation and their written article.

Between ‘Day 4’ and ‘Day 5’ all presentations will be held in front of a ‘real’ general audience (CE / OR)

Day 5: Completion

Morning session: Feedback from teacher on articles (OR / FAK); reflection on presentation and article (OR / FAK); evaluation of course (OR / FAK)

Appendix 3
Course evaluation 'Science communication for PhD students'

Course dates	8 January – 26 February 2010
Presentation	Anna van Rijn College / University Museum (3 / 5 Feb)

1. General course remarks

1.1	Are the general aims / objectives of the course clear?	Unclear / Clear	1 2 3 4 5
1.2	Does the course offer you enough space to tailor its contents according to your own needs?	Insufficient / Sufficient	1 2 3 4 5
1.3	Do you think the practical approach (working towards two concrete products) is useful?	Not useful / Useful	1 2 3 4 5
1.4	Do you think the peer review / feedback sessions are useful?	Not useful / Useful	1 2 3 4 5
1.5	Does the course have the right level of difficulty?	Too low / Too high	1 2 3 4 5
1.6	What do you think about the balance: invested time / quality of your product?	Bad / Good	1 2 3 4 5
1.7	What's your overall level of appreciation for the course?	Low / High	1 2 3 4 5

Strong and weak points General course remarks

2. Content

2.1	How useful did you find the course material which was offered?	Unuseful Useful	1 2	3 4 5
2.2 4 5	How challenging did you find the assignments? Challenging	Boring		1 2 3
2.3	How clear did you find the assignments and course material?	Unclear Clear	1 2	3 4 5
2.4	How satisfied are you with the feedback on the 'elevator talks'?	Dissatisfied	1 2 3	4 5
2.5	How satisfied are you with the creative exercises (mind map / dictionary exercise)?	Satisfied		
2.6	How satisfied are you with the 'metaphores' exercise?	Dissatisfied Satisfied	1 2 3	4 5
2.7	How satisfied are you with the general communication theory?	Dissatisfied	1 2 3	4 5
2.8	How satisfied are you with the presentation theory and the film of Hans Rosling ('Debunking	Satisfied		
	myths')?	Dissatisfied	1 2 3	4 5
2.9	How satisfied are you with the writing theory and accompanying exercises?	Satisfied		
		Dissatisfied Satisfied	1 2 3	4 5
		Dissatisfied Satisfied	1 2 3	4 5

2.10 How satisfied are you with the interview workshop? Dissatisfied 1 2 3 4 5 Satisfied

2.11 How satisfied are you with the feedback on the try- out presentations? Dissatisfied 1 2 3 4 5 Satisfied

2.12 How satisfied are you with the feedback session on the articles? Dissatisfied 1 2 3 4 5 Satisfied

2.13 How important is presenting in front of a real 'lay' audience for you? Unimportant 1 2 3 4 5 Important

Strong and weak points Content

3. Lecturer

3.1	How satisfied are you with the supervision / support of Liesbeth de Bakker?	Dissatisfied Satisfied	1 2 3 4 5
3.2	How clear was the teaching of Liesbeth de Bakker?	Unclear Clear	1 2 3 4 5
3.3	How inspiring did you find Liesbeth de Bakker as a lecturer?	Uninspiring Inspiring	1 2 3 4 5
3.4	How satisfied are you with the contactability of Liesbeth de Bakker?	Dissatisfied Satisfied	1 2 3 4 5
3.5	How satisfied are you with the guest lecturer of the interview workshop (Marnie Chesterton)?	Dissatisfied Satisfied	1 2 3 4 5

Strong and weak points Lecturer

4. Learning aims / Competences

4.1	How adequate is your knowledge / skill now in terms of presentations for a lay audience?	Inadequate Adequate	1 2 3	4 5
4.2	How adequate is your knowledge / skill now in terms of writing a popular scientific article?	Inadequate	1 2 3	4 5
4.3	How adequate is your knowledge in terms of different target audiences?	Adequate		
4.4	How adequate is your knowledge / skill now in terms of giving feedback?	Inadequate Adequate	1 2 3	4 5
4.5	How adequately can you now convey your inspiration for your work?	Inadequate	1 2 3	4 5
		Adequate		

Inadequate 1 2 3 4 5
Adequate

4.6 Overall, how much have you learnt? Not much
1 2 3 4 5 A lot

Strong and weak points Learning aims / Competences

Any other comments you'd like to make …. ? (for more space p.t.o.)

Appendix 4

Personal evaluation presentations (Anna van Rijn / University Museum)

Can you please give me (the lecturer) insight into a couple of issues:

- Please write down a strong and a weak point of your own presentation (your personal opinion)

- What were the main comments from your public (strong / weak) ?

- Did you learn anything new during the experience of presenting itself?

- Did you find out what the public wanted to hear from you (need-to-know)? Please write it down in 5 sentences.

Appendix 5

Appendix 1: Concise feedback form (for reviewing the first version of the article)

Author / Title: ………………………………………………………………Feedback from:

1. Read through the article in one go. Mark where the text reads smoothly and where reading is hampered. Text might be uninteresting, confusing or too difficult.

2. Please write down for the following categories what the strong and weak points of the article are. Add suggestions for improvement:

   a. Does the lead contain the right information (e.g. a summary and an incentive)?

   b. Is the focus (angle to the story) maintained throughout the whole article?

   c. Does each paragraph contain one main thought?

   d. Is there coherence within the text and each paragraph?

   e. Does the article have a clear (summarizing) ending?

   f. Is the most important information put first and the less important information placed more towards the end?

   g. Does the text read smoothly (a pleasant style and tone)?

218. Socio-cultural Cognition as a Moderator of Science Communication in India

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Abstract. Science communicators in India assume that people are isolated, N-number of individual units of asymmetrical scientific cognition and 'knowledge deficiency' which can be addressed by a top-down, structured, rationalized flow of information and education. They fail to understand that humans are an organic part of a socio- cultural 'whole' with complex cognitive and emotional inter-connectedness. Based upon our live experience of science communication in India and the review of extant literature, we have tried to disentangle the values associated with the scientific community's approach to science communication in India and those of the general public who are supposed to be enlightened.

Keywords: Cultural cognition of people, Deficit of knowledge, Pluralistic approach, Science communication, Top-down process

219. Scientific Awareness: Challenges and Opportunities for Linguo-Socio-Culturally Divergent India

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Abstract: Developing scientific awareness among the masses is the need of the hour. In this way one can connect the general public with the specialist scientific community. Every nation is trying hard to make their public scientifically aware for social welfare and development, national advancement, appreciation and criticism of scientific advances, to end the possible superstitions and blind faiths, to strengthen the public faith on the doctrine of science and for establishing a direct link between science and society. The difficulty of spreading scientific awareness in a country like India is further multiplied by the various challenges of linguistic, social, cultural and economic diversity prevalent in the country. To meet these challenges, it is very much required to exploit the available opportunities and to come up with new ones. The present paper proposes to discuss the various challenges and opportunities for spreading scientific awareness in India.

Keywords: scientific awareness, challenges, opportunities, India.

220. What drives Climate Change 'Drifters'

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Abstract. There has been a significant drift globally in public belief in anthropogenic climate change–with varying degrees of drift in different countries. Much effort has gone into trying to diminish this drift by better clarifying and arguing the science behind climate change. But evidence indicates that the drifters are not primarily motivated nor dissuaded by the science, and science-based discussions need to be radically reframed to have any impact upon them.

Keywords: Climate change, Sceptics, Public attitudes

Introduction

Several years from now, when science communicators have finished analyzing and dissecting the communications efforts of global climate change, it will most likely be seen as an excellent case study for the development of science communications thinking—towards being more audience-centric, and understanding the need for multiple and complex solutions to multiple and complex problems.

At least if we learn lessons from climate change communications it will be.

Much climate change communication could be described as 'almost good'–but that is like a bridge being 'almost long enough' to span a chasm. An irony is that, taken collectively, the many different communication strategies and theories being applied would probably span the chasm quite easily, and would constitute a multiple and complex approach. But many efforts to date have been characterized by being more competitive than co-operative.

This is in part due to the reverse panopticon prison effect.

To explain: the panopticon was a model prison, designed by the English philosopher and social theorist, Jeremy Bentham, in 1785. The basic concept was of a huge circular building of many jail cells, all with an open barred side on the inside, all pointing towards a central observation post. A prisoner could never tell when the jailer, sitting out of sight inside the observation post, might be watching them. The concept of the prison as a new mode of obtaining power of mind over mind, was later popularised by the French philosopher Michel Foucault.[1]

In the reverse panopticon, the perspective is turned around, so instead of having one central observer, we consider the perspective of the dozens, if not hundreds, of different perspectives from the cells, all looking towards a central point. And trapped inside the cells the prisoners have no idea of what the other perspectives might be, and can only see the world from their singular perspective. The irony, again, is that taken together they would have a more complete world view than would be possible for any one person.

This is the problem that has assailed much climate change communications, and indeed many attempts to address multiple and complex problems. It is repeated over and over whenever interest groups are captive to the limited perspective of their cells, and argue stridently that their singular perspective of the solution to any problem is the one that needs to be most heeded, and how the others' are clearly faulted.

The effect is also evidenced in the adage, 'We don't see things as they are, we see things as we are..[2] So let's begin by considering that the problem of climate change is multiple and complex, and therefore in need of multiple and complex solutions to effectively address it, and that this requires an attempt to pool as many different strategies and perspectives together as possible.

From that perspective, this paper looks at climate change drifters, those who once believed in or supported the idea of global climate change, but no longer do. The research is based on seeking to understand their perspectives, rather than seeking to convert them, for we should begin any attempt to better understand the drifters by talking to them rather than scorning them. By looking at a wide spread of research into into the psychological causes of climate change drift, including public attitude research and focus group findings from discussions with climate change drifters, some lessons can be learned as to the benefit of incorporating different perspectives into strategic communications towards this section of the population.

To begin with, five key lessons I have learned from ten years of dealing with public reactions to contentious technologies including stem cells, GM foods and nanotechnology, that are applicable to understanding the drifters:

1. When information is complex, people make decisions based on their values and beliefs.
2. People seek affirmation of their attitudes (or beliefs) – no matter how fringe – and will reject any information that is counter to their attitudes (or beliefs).
3. Attitudes that were not formed by logic are not influenced by logical arguments
4. Public concerns about biotechnologies and nanotechnologies (and climate change as well) are almost never about the science – and scientific information therefore does little to influence those concerns.
5. People most trust those whose values mirror their own. The first thing that it is vital to understand is that for many of the climate change drifters the issue is not the veracity

of the science, and arguments about the science do little to change their minds.

Deficit 2.0 Model

That the public or sections of the public should have a science-centric view of the world is what I term the Deficit 2.0 Model, based on the dogma that: If only you thought more scientifically (like me) you would get it!

Instead, I would argue that, if scientists and science communicators only thought more like climate change drifters, they would get it. 'It' being a better understanding of their perspectives, values and likely influences. And from having talked to many drifters, instead of asking: 'Why have so many members of the public changed their belief in climate change?', the more relevant questions seems to be: 'Given the circumstances, how could they not?'

So what exactly are the drifters telling us?

From the evidence of letters to the editor and talk back radio and so on, they key issue amongst climate change drifters appears to be a loss of confidence in the reality of, and the science behind, climate change. This is being articulated in these mediums as being due to several factors, including:

- Globally and locally governments can't agree on what do to,
- Scientists appear to disagree on findings and distort the truth,
- Emission Trading Schemes and Carbon Taxes are either very complex or in disarray,
- There are too many messages of over-whelming doom and gloom, and
- There is a feeling that nothing they do (or have done) really made any difference.

To test these statements the Department of Innovation conducted a focus group and an online poll with climate change drifters. The focus group was held in Melbourne on 17 May 2010. Participants were recruited based on their agreeing with the statement that they now believed less that climate change is happening than they had in the past. The group comprised:

- A 35-year-old single male, recruitment consultant for construction and engineering.
- A 44-year-old male, machine operator, married with a daughter.
- A 38-year-old married female, executive assistant.
- A 41-year-old married female accounts worker, with four teenage boys.
- A 45-year-old male, married with one daughter, working in aged care management
- A 29-year-old married female, employed with two daughters.
- A 46-year-old married investigator with two children.

The purpose of the focus group was to better understand the reasons for their decreased belief that climate change was happening, and the moderator began by presenting them with two statements and asking them which one they most aligned with.

STATEMENT 1: I feel a sense of disarray about climate change due to the complexity, lack of trust, doom and gloom and no indication of what to do about it.

STATEMENT 2: Climate change is not as bad as I've been told and I don't need to do anything or incur any costs.

All participants stated that they most agreed with Statement 1, and while not all participants agreed with all parts of the statement, they all wholeheartedly agreed that they felt a sense of disarray about climate change. In addressing reasons for moving from believing in climate change, key motivations given were:

Confusion

- There was a sense of cynicism within the groups that the climate change debate was largely controlled by the media and was now more about money than saving the world.
- Over the past few years the participants had heard various messages that climate change was getting worse, or that it was under control and also that it was not as bad a problem as it had originally been made out to be.
- Two to three years ago there was a much clearer message that climate change was a real problem; but this was not the case any more.

Lack of trust in government and science

- Coupled with not knowing what to believe, there was an overarching lack of trust in anyone who had an opinion on climate change.
- Government, both locally and globally, had a large part to play in participants' change of feelings towards climate change.
- Scientists, too, were accused of adding to the general confusion surrounding climate change; they presented conflicting messages about the reality and impact of climate change.

Clear and consistent messaging

- Their current state of confusion meant the participants were unlikely to trust anyone or know what to believe any more. Regardless of who were to deliver a message, be that a politician, a scientist or even a celebrity, the participants felt any message delivered would have a hidden agenda.
- Until a clear and consistent message about climate change was promoted and acted upon by those delivering the message (essentially led by government), there was little hope of the participants doing anything further than what they were currently doing.

Online poll data

These findings were then fed into the design of an online poll, held in June 2010, seeking to obtain data from a wider range of climate change drifters. One thousand people were surveyed, based on their being filtered for inclusion by agreeing to one of the following statements:

- I am confused as to what to believe about global climate change because of the conflicting messages,
- Global Climate change is happening, but is not as severe as we have been told.
- Global climate change is happening, but is not caused by humans,
- Global climate change is not happening.

The sample group surveyed could then be broken down into:

- The confused (52 per cent)
- The moderate sceptics (45 per cent)
- The most sceptical (2 per cent).

Among this group 55 per cent said their levels of concern about climate change had increased over the past years, 43 per cent said they had stayed the same and 3 per cent said it had decreased.

When just the moderate sceptics were filtered for this question (484 people), 45 per cent said their levels of concern had increased, 50 per cent said they had stayed the same and 4 per cent said they had decreased. Amongst the most sceptical (25 people) all stated that their concern had increased.

Trust in the claims of scientists amongst the overall sample and amongst the moderate sceptics was fairly consistent, with 20 per cent and 19 per cent having increased trust, 60 per cent and 58 per cent same trust and 20 per cent and 23 per cent diminished trust. But amongst the most sceptical there was no increase in trust: 24 per cent stayed the same and 76 per cent had decreased trust.

The divide in attitudes towards questions of belief in climate change amongst the general survey population, the moderate sceptics and the most sceptical is shown in figure 1.

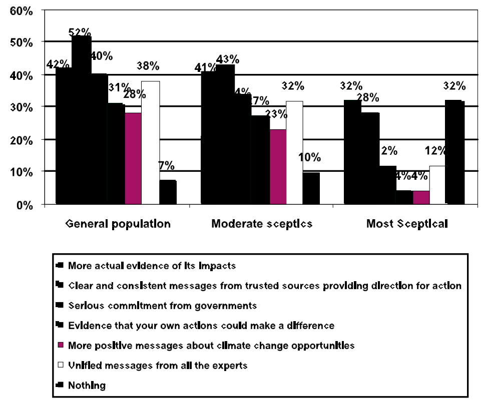

Figure 1: Which statement best describes your feelings about climate change?

Then, addressing the question: 'What types of information or activities might make you more convinced that climate change was a serious issue with significant impacts?' – the moderate sceptics were again not too far different from the general survey group, but there were significant differences with the most sceptical, as shown in figure 2.

It is fair to assume that the most sceptical are unwilling to change their positions, but the confused and moderate sceptics clearly stated what types of arguments or evidence was most needed to convince them of the reality of climate change. These are shown to be multiple and complex, and unlikely to be impacted by a single message.

An issues not addressed in this small study was the impact on attitudes of anti-climate change stories. But while there has been considerable debate on information versus misinformation in the climate change debate, it is perhaps more important to focus, not on the fact that there are many anti-science misinformation campaigns being conducted, but on the reasons they are resonating with a substantial proportion of the public.

The Psychology of climate change denial

This leads us to try and better understand the psychology of opinion on climate change. Attempting to correlate the findings of several studies, and achieve a wider perspective, there are some key findings that stand out.

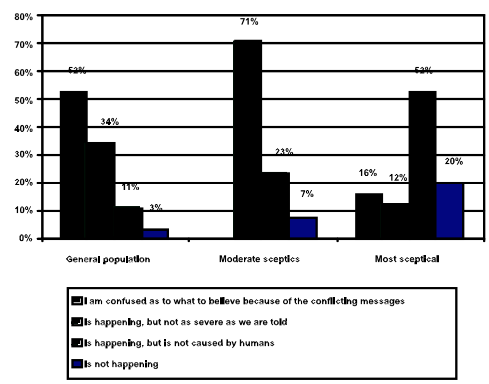

Figure 2: What types of information or activities might make you more convinced that climate change was a serious issue with significant *impacts?*

There has been a matched growth in both scientific evidence and scepticism and denial

According to Kari Marie Norgaard, a Whitman College sociologist, this seeming inconsistency can be explained as:

"Our response to disturbing information is very complex. We negotiate it. We don't just take it in and respond in a rational way. Climate change is disturbing. It's something we don't want to think about. So what we do in our everyday lives is create a world where it's not there, and keep it distant."[3]

Which indicates that more scientific evidence is probably not the answer.

Sustained doom and gloom messages conflict with many people's belief systems

Linda Connor, an anthropologist at the University of Sydney, has commented on this, stating that:

"As Ernest Becker argued over 30 years ago, the denial of death and the perpetuation of self and social group is the defining element of cultural world views…"[4]

She has said that negative messages about the future, such as those expressed in discourses of climate crisis, are a challenge to our cultural projection of immortality, and such negative messages, connected with death and decline, cause conscious and unconscious defence mechanisms that prompt us towards the life affirming messages of consumer capitalism.

Similarly, a study by Stoll-Kleemann, O'Riordan, Jaeger, found that in order to overcome cognitive dissonance, people's minds create a number of socio-psychological denial mechanisms. These heighten the costs of shifting away from comfortable lifestyles, set blame on the inaction of others, including governments, and emphasise doubts regarding the immediacy of personal action "when the effects of climate change seemed uncertain and far away".[5] This is quite similar to the reactions of the focus group held in Melbourne which suggest that negative messages

may turn more people into drifters, and more positive perspectives may be needed.

Psychological barriers to accepting climate change

According to the American Psychological Association, key psychological barriers to accepting climate change include:

- Uncertainty – over climate change reduces the frequency of 'green' behaviour.
- Mistrust – most people don't believe the risk messages of scientists or government officials.
- Social comparison - People routinely compare their actions with those of others and derive subjective and descriptive norms from their observations about what is the "proper" course of action. e.g. Al Gore's large residence has been used as a justification for inaction.
- Undervaluing risks – A study of more than 3,000 people in 18 countries showed that many people believe environmental conditions will worsen in 25 years from now. Which can lead people to believe that changes can be made later.
- Lack of Control – People believe their actions would be too small to make a difference/
- Perceived behavioural control - Climate change is a global problem, so many individuals feel that they can do nothing about it. This is the well-known collective action problem.
- Habit – Ingrained behaviours are extremely resistant to permanent change, while others change slowly. [6]

Attitudes tend to align with political viewpoints

Several studies have noted that climate change drifters and denialists tend to be politically conservative, while climate change supporters tend to be left learning, as shown in Figure 3, a poll of Australian voters and their alignment with different parties positions on climate change, produced for the Australian Climate Science Coalition. [7]

While it is over simplistic to conclude that a person's political leanings govern their attitude towards climate change, it may be more the case

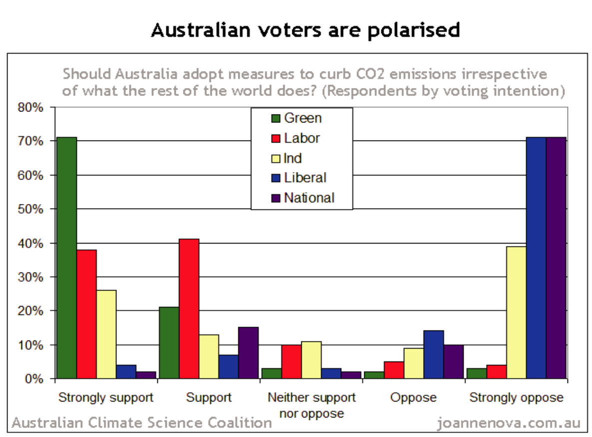

Figure 3: ACSC Poll of Australians attitudes to climate change and political affiliation

that a person's underlying personal philosophy as to whether humans should dominate the planet (anthropocentricism), or live with the planet (geocentricism), is one of the drivers of political ideology and climate change ideology both.

Which brings us back to a need to better understand different people's values, from their perspectives. Public attitudes tend to eventually achieve a natural balance point, that can be distorted in the short-term by information, misinformation and disinformation campaigns. But until that happens climate change drifters will continue to find the messages that best accord with their values.

For those working in science communications, who see the major challenge as being to maximise understanding of global climate change and encourage mitigating behaviours, this appears more likely to be achieved by changing their messages to better align with drifters' values rather than trying to shift the drifters' attitudes through any well-reasoned scientific data or evidence.

Conclusions

So what does it all mean? Well, two key messages:

Firstly, the issue of climate change is a multiple and complex one, or a wicked problem to use a more contemporary expression, and will only be effectively addressed by multiple and complex solutions that bring the multitude of different expert perspectives together, and more effectively work with each other than against each other. It is a matter of increasing the length of the bridge, or bringing all the cells in the panopticon prison together, or putting all the pieces of the jigsaw puzzle together – you choose your favourite metaphor. There is some evidence that we are getting better at this, demonstrated by efforts such as the Australian Science Communicators Hot Air Symposia, which have pooled an enormous amount of data to develop into a guide for communicating the science of climate change.
[8]

Secondly, to effectively communicate with any of the many segments of the public, such as climate change drifters, communications must be framed from their perspective and understanding – not the perspective and understanding of scientists nor science communicators.

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221. Neuroscience: Experience of an Interdisciplinary Dialogue

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Abstract. Looking at the covers of the most important scientific journals or lay magazines published in the last few years an evidence emerges: brain is the favourite subject, its secrets the cover topic. If in the 90s we had the “brain decade”, in recent years neurosciencepromises, expectations and doubtshave broken the boundaries of scientific research, reaching the society.Scientific studies and technical advancements in brain science are opening new perspectivesin medicine in terms of diagnosis and therapies. In the meanwhile, new technologies are finding non- clinical applications: the use of brain imagingin the courtroomsis one example.

Scientists, clinicians, patients, philosophers, lawyers, communicators, sociologists, lay people: the number of stakeholders playing a unique role, each one with his own questions, worries, needs, points of view is surprisingly wide. The bid-brains in dialogue is a three-year project supported by the EU 7th Framework Programme coordinated by SISSA (Trieste, Italy), that offers occasions and platforms formeetings, discussions and exchanges. Focusingon brain imaging, predictive medicine and brain devices, bid has been working since 2008 to address its mainaim: fostering the dialogue between science and society on the new challenges of neuroscience.

The bid represents a rare example of project that aims at highlighting the crucial issues in neuroscience through the voices of different people deeply interested in its progress. Several participative methods for discussion have been tested during workshops and public conferences organized in different European locations. From these events, the bid staff has produced video interviews, articles on European lay and scientific journals (e.g., “Frontiers in neuroscience” and “EMBO reports”) in order to disseminate the information and points of view. All the material is at disposal on a constantly updated website (www.neuromediacorner.eu) where experts and lay people can find news, scientific content, research centres, events, etc.

Despite the interest and efforts of the different stakeholders, it is clear that more dialogue is needed. Voices we listened to do not appear prepared and ready to meet and confront to each other. An improvement in public engagement seemsmore and more urgent to foresee and anticipate future critical debates, situationsand choices at a scientific, socialand political level. Many are the recent examples: just before the bid-workshop focused on the scope and limits of brain imaging, a controversy started in US on the use of fMRI to understand the voters’ impressionsduring thelast presidential election.Similarly, this year, just after the bid-workshop “brains in dialogue on genetic testing”, the Food and Drug Administration sent letters to five companies that sell genetic tests directly to consumers ordering them to prove the validity of their products. The paper and the presentation will report the project results and methods as well as the most important topics and crucial issues emerged.

222. Communication for Proactive Environmental Education: Towards Sustainability

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Abstract. One of the major challenges to address the issue of sustainability has been to plan, promote and implement environmental education from initial to higher levels of education world-wide. In accordance with the general framework envisaged in World Environment Education Congress held at Johannesburg and also in tune with other International Organizations although are being implemented elsewhere. Environmental Education is a process of recognizing values and clarifying concepts in order to develop skills and added tools necessary to understand and appreciate the inter-relationship among man, his culture and his bio-physical surrounding. It is expected to create an overall perspective, which acknowledges the fact that natural environment and man-made environment are interdependent. It should consider the environment in its totality and should be a continuous lifelong process beginning at the pre-school level and continuing through all stages. It should be inter-disciplinary and examine major environmental issues from local, national and international points of view. It should utilize various educational approaches to teach and learn about and from the environment with stress on practical activities and first-hand

experience. It is through this process of education that people can be sensitized about the environmental issues. Thus effective communication to public becomes more important. This has been envisioned through a national perspective. However the issue of sustainability in a broader frame of Communication to Education and then sustainability of lives and livelihood particularly for the developing world is of paramount importance and public well communicated can effectively contribute in achieving the goals of sustainable development. Thus along with communication the emerging issues of climate change and conservation of natural resources which pivotal for broader issue of sustainable development.

223. "Stars of Asia" Project

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Abstract. "Stars of Asia"project is one of IYA 2009 activity with collaboration of Asian area. It aims to collect and edit Asian excellent myths and legends relating to stars and universe through the collaboration of Asian countries/regions and then publish attractive books of Asian myths/legends of stars in each country/region for the public, children and teachers, so that many people can enjoy those stories in school, planetarium, and at home.

In 2009, we held the "Stars of Asia Workshop" at NAOJ Mitaka, Tokyo, Japan. The participants brought 65 myths and legends from 14 countries/regions. At the workshop, we organized the Editorial Board nominated from each country/region for editing a book of "Stars of Asia". The members of editorial board are preparing to publish attractive books of Myths and Legends about Stars and the Universe of Asia for children, people, and teachers in Asia and the world. The editorial board edits a common book of "Stars of Asia" in English, then translate to each country/region language, so that we can share rich culture of stars throughout the Asia and Pacific area. The English common book contains 3 parts, Part I: Myth and Legends of Stars and Universe Loved by Asian People, Part II: The Sun, Moon, Stars, Universe, and Human Being, Part III: Ancient Astronomy and Universe of Asia. The editorial board selected several popular stories from each country/region, then laid them out in the part I. Relatively short and classified stories by celestial objects were laid out in the part II. The part III includes the universes of Ancient India and China and traditional way to know the direction and latitude for sailing on the Pacific Ocean. At the end of the book, Origin, Flow and Evolution of Asian Myths and Legends are summarized. In total, the book has about 200 pages with 73 stories.

Not only stories but also illustrations in this book are very attractive. Through the colorful illustration gathering from Asian area, people would feel various cultures and histories of Asia region. Various stories appear from each religion, climate, and geographical features. Contrary, a common story in the wide area, like the story of Vega and Altair exists. It seems to be brought by the racial migration and religious propagation. "Stars of Asia" project may be a first trial to collect myths and legends on stars and universe from the entire Asian region. People can also enjoy the book from a point of view of ethnology.

224. Ewriting Netbred Processes Challenging Intellectual Property **Theories and Statutes**

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Abstract. Ewriting (electronic writing) generates theories, practices and computer applications that evolve and continuously redefine our perspective on writing. The genealogy of writing is being redefined considering that mind-net interacions are now prevalent in writing processes. Texts can be printed, digital, web-present, virtual; they are becoming translocal, collective, distributed, interconnected and hyperlinked. Traditionally considered enclosed objects now they can be seen as potential sources for re-information, matrixes for interrelation and reconstruction. In this writing environment, words, phrases, paragraphs would instantaneously reverberate through massive datastructures. Intelligent agents would interact with propositions to pose questions, to alter syntaxes and to make available complementary data. Writings pertaining to similar categories could be automatically interlinked and aggregated so that new content is generated and communities are formed along interests, styles, abilities or customs.

Ewriting tools will challenge deep-rooted cultural habits at the base of our language and thought processes. An intense focus on language will trigger in-depth research into new forms of textual processing. Ewriting reconceives individual authorship into a multi-dividual, socio-machinic, planetwide process. Once ewriting becomes widespread and acknowledged in theory, collective web-based writing, machine-assisted and machine-generated authorship will be investigated as human-developmental tools. Writing, and by extension, thinking, science, design, expression, artmaking, architecture, economics and philosophy will be more and more understood as a dialogical process between human abilities and machine-mediated actions.

As we let our imagination delve into these future forms of thinking, we come to the conclusion that instituted theories, enforced by legal systems, act as insurmountable obstacles to the advancement of creativity, authorship and invention. The problem is that legal theories and legislations, ingrained in almost unchangeable statutes, restrain emerging collaborative authorship models and practices. Thus, current intellectual property values and legal theories will be obliged to readapt to new forms of authorship involving human machine integration.

Keywords: Ewriting, Electronic writing, Theories and practices; Ewriting netbred processes; Authorial web-processes; Intellectual property theories and statutes

225. Mother Tongue is the Best Tool for Communicating Science

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Abstract. Language confidence plays a vital role in the development of scientific thought and, consequently, in learners' acquisition of scientific knowledge. The language mastering level and the internalization depth of word-concept and expression-concept correspondences within the mother tongue are unparalleled by any other language that a person may use, making the mother tongue the optimal vehicle for public's familiarization with the concepts and methods of science and for the development of skills essential to such familiarization, like visual literacy, logical abilities and abstract thinking. This paper provides extensive documentation on the impacts of using a alien language different from the mother tongue to approach scientific messages, through the analysis of the difficulties encountered by public in understanding scientific messages. The results stress the importance of utilizing the mother tongue to disseminate science news, at least until the audience acquires sufficient familiarity with the scientific words and simultaneously develops adequate mastering of relevant skills. This acquisition will constitute a solid foundation enabling clear identification of the science topics when utilizing other languages, so that the use of other languages can expand the range of communication possibilities and add the benefits ensuing from the different reflection-perspectives inherent in using different expression tools.

Keywords: Language, Mastering, Mother tongue, Science communication

226. Measuring Noise Levels in Delhi

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Introduction

Many recent studies have revealed that exposure to environmental noise above the prescribed standards limits have many adverse effects. It enhances the risk of hypertension, ischaemic heart diseases, hearing losses and sleep disorder. Also, it pessimistically influences efficiency and social behavior of a person. Recently, an NGO Chetna filed a case in the Delhi High Court seeking intervention to bring down the noise levels caused due to aircraft engines during landing at the Delhi airport. The extremely high noise levels are causing serious health problems to the residents of the nearby localities. Recognizing in noise pollution a serious hazard to health and efficiency as well as a source of increasing complaints from the public, the measurements of noise levels across Delhi becomes an important study. Based on the analysis of measured data, appropriate measures leading to avoidance, prevention, and reduction of environmental noise can be taken. It will help in bringing eco-friendly environment to the society.

Objectives

The main objectives of the present studies are as follows:

- To measure the noise levels in Delhi
- To compare the measured noise levels with Standard norms
- To identify the significant sources of noise and suggest remedies to reduce the noise levels
- To create public awareness and educating them
- To facilitate the planners and policy makers in taking appropriate decisions

Methodology and Equipment

For measuring the sound levels, Delhi region will be categorized into Residential, Commercial, Industrial, Silent and zones near the airport. The locations will be selected so as to cover all the zones. The measurements will be done in the month of September/October during peak, non-peak and night hours.

The equipment used consists of a sound level meter and a data acquisition system, LabQuest. LabQuest is a stand-alone data collection and analysis device, controlled by the color touch screen and the keys on the front panel. The Sound Level Meter measures sound level in decibels. The measurement range is from 35 to 130 dB with time weighting, frequency weighting and maximum level hold functions. It can be connected to LabQuest through its sensor port. The data recorded by the sound level meter can be stored online into LabQuest for later analysis.

227. Research on Public Science Literacy in Xiaoguan Communities, Chaoyang, Beijing

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Abstract. In order to understand the basic situation of public science literacy in Beijing communities, in May of 2009, we launched the "citizen science literacy" investigation in xiaoguan street communities, Beijing, China. We took two-stage unequal probability sampling to survey. The recovery of the valid questionnaires was 2100.This paper compares and analyzes survey data and analyzes citizens access to scientific information channel and attitudes to science and technology, which affected the factors of science literacy. It puts forward suggestions as to how to improve communities science literacy.

Key words: Communities population; Science literacy; Survey

228. Looking for a Media Skill Course Recipe?

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Abstract. Many journalists, communicators, educators, are engaged in Media Skills courses for scientists. The courses offered vary wildly. They range between seminars no longer than a couple of hours to few days long workshops. Some of the courses focus on meeting with video reporters, others prefer to focus on writing techniques. Some courses are designed for senior academic staff, others are directed to early career scientists, that is to say publics with different pressures, needs, and expectations.

To date media skill teachers need to develop their own concepts, produce their own supporting materials and exercises. They often develop exercises based on their own experience or adapting practice from other, similar, courses (ie creative writing courses). Currently, we have no demographic for such courses and involved trainers. We do not know how many of us are involved in this activity, nor with what degree of success, or satisfaction (on both the trainers and the trainees sides).

Journalists, communicators, educators, involved in such activities, along with those who could be interested in developing and promoting these courses, are invited to join this discussion. They are invited to actively participate, presenting their preferred exercises, exposing the obstacles they find in giving the courses, the obstacles found in promoting the courses, the feedback from attendees and institutions. The major goal of the session is that of sharing a set of exercises that have been proved to be successful in teaching scientists to improve dialogue with the media. With a subsequent goal to build an exercise-kit that could be distribute to media skills teachers - the best recipe for a media skill course.

229. Celebration of Ganesh Festival: Environmental Issues in the State of Maharashtra, India

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Abstract. India is the country of festivals. The celebration of festivals today has become a subject of discussion. The proposed study enquires into the present state of the celebration of the Ganesh festival in the state of Maharashtra, India. The idealistic rationale behind the celebration of the festival has the socio-religious basis which inculcates among people the sense of unity and integrity. The analytical study of the initial stage of the festival and the current state of celebration indicates a drastic difference. The idealistic rationale seems to have lost and the celebration today is leading to several serious environmental issues. The study investigates the impact of the festival on the environment and presents statistically how it has led to a radical increase in the noise, water and air pollution in recent years. Today many NGOs are working to spread awareness about the issue but the communication has to be at a greater level and hence the masses need to know the hazardous impact of the celebration more effectively. The recommended model (as below) through this study endeavors to create this awareness on a larger scale.

Keywords: Communication, Environmental issues, Ganesh festival, Pollution

Introduction

India is well known for its culture all over the world. The Indian culture is an admixture of diverse cultures within the country. 'It appears as if the inhabitants from the Himalayas in the north to Kanyakumari in the south, and Kutchh in the west to Arunachal in the east are woven together into a beautiful tapestry'.1 The unique feature of the Indian culture is its unity in diversity. The Indian society is secular and hence accommodates people from diverse socio- religious backgrounds open-heartedly. This discussion on diversity leads us to the varied socio-religious practices and ways of life of people in India. The celebration of innumerable festivals is an outcome of this dynamic socio-cultural set up. People of different religions celebrate the festivals which have been a part of their traditions since ancient times. The Hindus in India are said to celebrate the maximum number of festivals which have been recommended since the Vedic times. The very concept of worshiping the 'Pancha Yajnya', has led to different religious beliefs and practices. The Vedic scriptures such as Manusmriti and Rigvedas have recommended people the ideal ways of life. These practices gradually became larger and social communities started celebrating them on a greater scale. The celebrations of these numerous festivals lead to creating peace, harmony and social and cultural unity among the members of the society. It cannot be denied that these festivals have their base on many prescribed socio-religious concepts and hence they are an integral part of India's unique cultural identity. In modern times also, the people of India celebrate festivals quite vigorously and enthusiastically. It has been observed that in recent times, a majority of people seem to have forgotten the ideal rationale behind the celebration of the festivals and the extravagant celebrations are leading to create several environmental problems. The present study investigates the celebration of the Ganesh festival in the state of Maharashtra and probes into its impact on the environment leading to increase in the leve l of pollution. The major objective of the study is to make recommendations for the more effective mass communication of the eco-friendly Ganesh festival.

Background

The Ganesh festival is celebrated by the Hindus in India in the Hindu month of Bhadrapad (August/September) from the Ganesh Chaturthi (the Day of birth of the lord Ganesh) to the Anant Chaturdashi i.e. usually the period of 10 days.

The tradition of the devotion to Lord Ganesh among the Maharashtrian Hindus can be divided into two categories: a) The Sectarian b) The General or Universal. The sectarian Ganesh devotees (Ganesh Sampraday) can be traced back as early as the sixth and seventh centuries. The sectarian movement was limited to the Brahmins who worshipped Ganesh as their family deity (Kuladaivat) or devoted themselves to Ganesh for reasons of personal choice (Ishtadaivat). The Ganesh cult fully bloomed in Maharashtra during the reign of Brahmin Peshwas (Rulers of the Maratha kingdom in the 18th century). They themselves worshiped Ganesh as their Kuldaivat. They sponsored

Ganesh festival during the Hindu month of Bhadrapad (August/September) publicly to demonstrate their religious sentiments and invoke Lord Ganesh to protect them from obstacles. Today this Ganesh cult is limited to the Deshstha and Kokanastha Brahmins.

The general or universal devotion to Lord Ganesh is expressed by Hindus of all castes and sects. Hindus regard him as the 'Over-comer of obstacles'. The Ganesh festival which was restricted only to the Brahmins was brought into public and general observance through the efforts of Bal Gangadhar Tilak in Pune in 1893 as a means of mobilizing large number of Hindus for religious revival and political independence from the clutches of the British. Since then the Ganesh festival has been celebrated quite vigorously and enthusiastically by the Hindus in India.2 The celebration of the festival today takes place on a larger scale through the intermingling of traditional and modern practices, which have been discussed below.

Traditional practices

The traditional practices can also be called as idealistic practices of the celebration of Ganesh festival as the rationale behind the celebration had been idealistic and the objectives were spiritual and social. Socio-religious integrity has always been an objective of the festival. The festival is celebrated at two levels A) Individual B) Social community. The ritualistic placement of the Ganesh idols on the day of Ganesh chaturthi and the immersion of the idols into water on the day of Anant chaturdashi is the tradional practice. During this period, the idols of Ganesh are worshiped by performing various religious rituals in the houses and the social pandals. On the day of the Anant Chaturdashi, public processions of the Ganesh idols of the social communities are conducted and at the end of the day the idols are immersed in sea, rivers and public lakes and wells.

Modern practices

Although the traditional practices are followed in the modern times also, the celebration has become more extravagant with the increase in population and therefore the number of individuals and social communities. The innumerable Ganesh idols (made of clay and plaster of paris by the local sculptors) are purchased at the individual and social community levels. The celebration of the festival takes place on a huge scale that is leading to several environmental issues. The immersion of the Ganesh idols and other material required to perform rituals lead to cause water pollution whereas the huge loudspeakers played during the whole festival increases noise pollution. The hazards are well-known but are little considered by the masses.

Impact on Environment

The Celebration of Ganesh Festival today, particularly, its immersion process has adverse effects on environment. It causes pollution quite severely, viz. noise, water and air pollution. The present study endeavors to analyse this issue and provide measures and recommendations for their effective communication. The detailed analysis of these 3 types of pollution has been presented in the subsequent points as below.

Noise pollution

The firecrackers used during procession, cause noise pollution. It has adverse effect on the health such as hearing loss (temporary or sometimes permanent), high blood pressure, heart attack and sleeping disturbances.

The drums, music systems used during procession create noise which is very much above the normal level.

According to D.B. Smith, 60 dB (decibels) is the normal level of noise during conversation, while 80 dB noise is painful3. As illustrated in Table 1, the noise level during Ganesh festival is far above these values.

Table 1: Noise level observed in major cities in Maharashtra during Ganesh Festival

Name of the city	Noise Level in dB 'A'					
	2007		2008		2009	
	Min	Max	Min	Max	Min	Max
Mumbai	63.4	102.7	50.2	91.3	46	105.8
Navi Mumbai	85.9	100.6	51.3	95.8	42.1	93.3
Thane	59.2	92.4	56	96.5	60.1	95
Pune	56.8	99.3	62	107	53.3	101.8
Nashik	40.2	89.3	41.9	99.8	61.5	97.3
Aurang-abad	65.2	114.1	51.3	99.5	41.3	96.5
Nagpur	62.2	98.3	60.7	85.9	53	89.6
Kalyan	65.4	103.8	59.6	92.7	67.8	95.7
Amravati	52.6	93.6	59	79.7	51.7	85.6
Jalgaon	54.0	102.9	60	79	54.5	96.3
Kolhapur	56.9	105.4	65	86	52.9	104.5
Satara	62.5	96.7	66	100	66.1	92.2

(The data is excerpted from the 'Report 2009' of the Maharashtra State Pollution Control Board.4)

Almost in all major cities, it is approaching to 100 dB. Decrease in trend in noise level is observed in Navi Mumbai and Aurangabad in the last 3 years. It is due to the various citizen awareness programs and campaigns conducted by Maharashtra Pollution Control Board and other Regulatory Agencies.4 It indicates that if communication is effective and on the larger scale, it will help in improving the situation.

Water pollution

The immersion symbolizes the return of Ganesh from the earth, after removing the obstacles and unhappiness of his devotees. If it is a small idol (upto 1 feet height) which is made up of natural soil, it will not affect the water after immersion. But due to giant sized idols (above 25 feet height), that too, made up of plaster of paris prove to be hazardous to the environment. Also the material used for the decoration purpose is non-degradable that comprises thermocol, plastic which again leads to pollution. All these factors are summarized in Table 2.

The water pollution caused by the immersion affects quite adversely the aquatic life as well. In the nutshell, it could be stated that the immersion of innumerable idols into different water resources causes serious pollution.

Table 2: Effect of immersion process on water

Cause	Contents	Effects
Immersion of idols	---	Block the waterflow resulting in stagnation and breeding of mosquitoes and other harmful pests
Plaster of Paris	Gypsum, sulphur, phosphorus, magnesium	Take several months to dissolve in water and poisons the water of lake, ponds, river, wells etc.
Chemical paints	Mercury, lead, cadmium, carbon	Increases acidity and heavy metal content of water
Decorative material	Thermocol, plastic	Being non-degradable causes pollution of water,

Air pollution

Firecrackers used during the procession lead to air pollution. The chemicals used in firecrackers are harmful to the health of living beings as indicated in Table 3.

Table 3: Effect of firecrackers on health

Chemical	Impact
Copper	Irritation of
respiratory tract Cadmium	
Anemia and damage to kidney Lead	
Affects the nervous system	
Magnesium	Its dust and fumes cause metal fume fever
Sodium	Reacts violently with moisture and can
attack the skin. Zinc	Leads to vomiting
Nitrate	Could lead to mental impairment
Nitrite	Could lead to coma

(Data Excerpted from the official website of the ***Kalpavriksh Environment Action Group, Pune5)***

Measures to Save Environment

- The idols of Ganesh should be strictly made of naturally occurring clay (shaadu) which dissolves in water within a few hours after immersion.
- 'One idol per village or area or housing society' will reduce the number of idols to be immersed. It is to be noted that nearly 1.5 crore idols are immersed in the major cities of Maharashtra.
- The immersion should be done at home in a small water tank and the clay can be utilized for plants. This will avoid the pollution of the natural water resources such as sea, rivers and lakes.
- Instead of immersing idols, betel nut which symbolizes the idol may be immersed. The same idol can be used every year.
- Use of permanent idols such as idols made of metal, silver, marble stone will avoid water pollution.
- Natural colours should be used for the idols.
- The decoration material should also be incurred from natural resources i.e. flowers and paper etc. The use of thermocol and plastic should strictly be avoided.
- The material used for the rituals during the festival should not be disposed of in water.
- The use of loud speakers and music systems should be strictly prohibited by law to avoid noise pollution.
- There should be control on the use of crackers during the festival.
- It is a responsibility of the individuals to limit the use of colours during the procession as they have harmful effects on skin and eyes.

Recommendations

As the measures suggested above are important and even several NGOs and Government agencies try to spread awareness about them, it has been observed that the implementation of these measures fails to a greater extent. The extravagance of the celebration of this spiritual festival continues to degrade the environment and increase the levels of pollution. The problem identified through the study is the ineffective communication of these measures which must be communicated effectively if they are to be implemented successfully. Several NGOs and Government agencies are trying to communicate the measures to masses but the communication needs to be done on a greater scale. The recommendations for the effective communication of these measures are presented as below:

- All these measures can be incorporated in the syllabus of the subject 'Environmental studies' in primary schools and colleges.
- Awareness programmes such as slide-show presentations, street-plays can be organized on a greater scale in schools, colleges and at public places.

- The government agencies, NGOs, schools and colleges may form groups for carrying out such awareness programmes on a greater scale.

- Small video clips can be shown in the cinema halls before the movie starts or during intervals.
- The video clips may also be shown on national television for spreading awareness.
- Leaflets describing the measures can be circulated a few days before the Ganesh festival through newspapers.
- Posters and hoardings communicating the measures may also be displayed at public places.
- Banners prohibiting the immersion of idols may be displayed at seas, rivers, lakes and ponds.
- The print media such as newspapers and magazines may publish the measures for the eco-friendly Ganesh festival.
- A documentary showcasing the harmful impact of the current practices should be prepared and shown at public places.
- Public announcements regarding the Dos and Don’ts may be made before and during the festival.

Acknowledgement

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230. Multipronged Approach for Popularization of Science and Technology among the public

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Abstract. The rate at which Science and Technology is advancing in the world is simply unimaginable. It needs superhuman efforts to communicate Science and Technology to the public. However a large number of steps are already being taken by Govt. and Non-Govt. organisations in this regard. Yet it is inadequate. One solution appears to be to make it a mass movement. For this a multipronged approach may be made to expose and train the heads/leaders of various groups who can take Science and Technology down to the individuals at grass-root level.

Keywords: Mass movement, MP, MLA, Multipronged approach, NCSC, Panchayat Raj, People's representatives, Science centres, Student

Introduction

A glimpse at the steps taken in the past for popularisation of science by Govt. and Non-Govt agencies would indicate that, perhaps no stone has been unturned in this regard. Some are useful, some very useful and some are excellent.

Pamphlets, Leaflets, Articles in Print Media; Books, Magazines, Radio, Television, Talks, Debates, Jathas, Slogans, Morchas, Posters, Flagmarch with placards, Exhibitions, Museums, Quiz Competitions, science based Cultural programs and Folk art etc; are only indicative and not exhaustive. Prizes are also awarded as incentives for all these. Yet, it appears, there is much more that can be done.

Can this be converted to a mass movement - a movement to which people from all walks of life can be roped in? They can be made to be actually involved and contribute significantly in their own way.

Multipronged approach

Yes! It is possible. For this we can have a multipronged approach. We have to identify the groups, create awareness among their leaders/heads and train them. An approach can be to identify them by their age group, level of education, their pursuits of daily life, vocation, profession etc. For example, we have students, teachers, doctors, politicians, peoples' representatives, administrators, assistants, scientists, business people, corporate houses, social workers/self help groups, women groups, tribal groups, industrialists, labourers in organised and unorganised sectors; armed forces of all wings and paramilitary forces etc.

These different groups have different levels of education, understanding, exposure and interest. Hence while taking science to them; we have to adopt different approaches, strategies, methodology, techniques and mediums.

One can design and distribute leaflets, booklets, documents for different groups, organise meetings, training programs, workshops and interactive sessions. The duration of the programmes can be varied, from a few hours to a few days and spread in different locations. For top echelons, we may choose Secretariat Conference Room, Administrative Academies; for MLA's, Assembly or suitable Halls; for MPs, Conference Halls; for Collectors/Block Level Officers, collectorate conference halls and so on. For the grass root level, there are respective Panchayati Raj office premises. These meetings or workshops can be repeated for different groups.

The leaders in turn can take suitable steps for bringing science to the groups they head, formulate programs within their scope for inculcating scientific temper, removal of superstition and blind beliefs as well appreciation of scientific activities & achievements at different levels.

Experience

The approach indicated above is based on some experience we had way back almost three decades hence in the Department of Science Technology and Environment when a massive program was launched for creating awareness on Environment, various issues involved, steps to be taken at different levels, the roles to be played by the various groups and individuals, policies to be advocated for adoption by Govt. etc. A number of incentives and awards were instituted. These have since become a part of the system and have done yeoman service for creating an impact on protection of the Environment in the State.

Another program recently organised by the P S Planetarium, under the aegis of DST, GOO is 'Scientific Exposure Visit' for students selected from schools under Tribal Sub Plan of the state. One student from each of the 254 schools are brought to Bhubaneswar, accompanied by some teachers and camped for four days. During this period, eminent scientists gave talks, visit to scientific institutes, like Institute of Physics, IMS, PSP, RSC, RMNH etc; were organised. Participants made notes on their observations and had interactive sessions at the end of the day. Selected students were awarded prizes at the Valedictory function. This is the 2nd year in succession. The participants had a rich experience which was communicated to their school mates. Let us consider some of the groups:

Students

Students constitute the major part of the society. As the future generation of the country, this group deserves maximum attention. Rightly so, a large number of programmes are being implemented. Besides science as a part of the curriculum, the other programmes are Science Exhibition talks or lectures, various competitions, National Children's Science Congress–starting from individual schools to National Level participation with a focussed theme, Science Centres under NCSM, though vary few in numbers; observation of various National Days like NSD, World Environment Day, Technology Day, Science Express, though only a small section is benefitted; Programmes on TSP, Olympiads and so on. Yet a few more things can also be done. More science based programmes can be broadcast by Radio, which will reach remote corners where there is limited scope for TV. The scope of students from remote areas to visit Science Centres, Planetaria may be increased. Mobile Science vans and Mobile Planetaria may be increased. Popular Science Magazines in local languages already available at subsidised rates may be sent to interior schools possibly at highly subsidised rates.

People's Representatives:

India is a democratic country. Policies are made by People's Representatives. Government Machinery is run by a vast network of committed Bureaucracy, overviewed by People's Representatives. They are the persons who interact with people whom they represent. Hence Science should reach them first so that they can appreciate the programmes and in turn take them to the people. That is the way their outlook will change to at least at limited extent, overcome superstition and blind belief, creating awareness of Health, Hygiene and Sanitation and protect the environment.

- At National Level: Members of Parliament; Members of Rajya Sabha
- At State Level: Members of Legislative Assembly
- At Municipality/Corporation/NAC Level: Councillors/Mayors, Chairpersons
- At Panchayat Level: Panchayats/Sarpanch

The Panchayati Raj is a system which enables people to run their own local Govt in rural areas.

The Panchayati Raj is a three tier system. It works at three levels–

- The gram panchayat at the village level,
- The block samiti at the block level and
- The zilla parishad at the district level

In our country, the system of Panchayats is very old. In 1992, the Central Govt. Amended the Constitution and formulated rules for the Panchayati Raj System. These rules became effective from April 1993.

The Gram Panchayat has various duties with emphasis on developmental activities such as agriculture, primary education, health and sanitation and responsible for implementing the Community Development Programme at village level.

- Block Samiti–Elected members + State Legislative Members + Members of Parliament of that area
- Zilla Parishad–Apex body of the PR System. Elected body + MLA + MP
- These institutes of Local Self Govt. also help to bring about social change.

Local Self Govt. in Urban Areas

A Municipality or Municipal Council is Local Self Govt. body in smaller towns and cities. The population of a town or city determines the number of members in the Municipality (usually in between 15 to 16). A head of the Municipality is called Commissioner or President.

In case of large cities, the Local Self Govt. body is called Municipal Corporation. The number of elected members is usually between 50 and 100 (may be more as in Delhi and Mumbai – 134 to 221). The head is known as

Mahapur or Mayor. The functions are:

1. Maintenance of public hygiene
2. Public Health
3. Public conveniences
4. Registering Births and Deaths
5. Education
6. Roads and Bridges
7. Solid Waste Management

Note: A Nagar Panchayat is set up for an area that is changing from a rural to an urban type – Transitional area.

State Legislature

- Legislative Assembly (Vidhan Sabha or Lower House)–The strength of State Legislature varies according to the population of the State concerned. The total strength for all States/UTs in India is 1485.
- Legislative Council (Vidhan Parishad or Upper House)–The strength varies as per the population of the State, limited to 1/3rd of the strength of Legislative Assembly.

Parliament

- Lok Sabha: Maximum strength is 550 + 2 nominated members (530 States and 20 Union Territories).
- Rajya Sabha: Maximun strength is 250.

In the preceding paragraphs, we have mentioned the People's Representatives of various categories starting from Panchayat Raj to Parliament. This indicates how effective our approach would be if they are individually and severally groomed in Science and Technology by way of exposure and training, however short they may be.

Women's Group

Currently with the support from different programs at State and National level, several Women groups have become active and undertaking activities for socio-economic development.

We may focus S&T communication for this group which will be very effective in achieving our objective.

Tribal Group

The Tribal Group constitute a significant percentage of the population in several States. Along with the development programs they may be exposed to Science and Technology in an appropriate manner to appreciate the role of S&T for Social-Economic development and well being besides developing a scientific temper and removal of superstition.

In addition to the above, there is another group/section that may also be roped in. They are the officers of Major Corporations who contribute to programme of Social Relevance. In fact the Social Corporate Responsibility is now a programme built into the system/organisation. They are already doing yeoman service for the welfare of the society where they are active.

Conclusion

For effective communication of Science and Technology to the public, there should be a mass movement and a Multipronged Approach is highly recommended.

231. Public Perception of S&T and Public Policies for Science Communication in Brazil

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Abstract. In this communication we will present the results of a recent survey (June 2010) on public perception of science and technology (S&T) in Brazil. The results will be compared with a similar survey realized four years ago. This survey was conducted by the Ministry of Science and Technology, with the collaboration of Museum of Life/ Fiocruz. The interviews were realized by using a structured questionnaire with a statistically representative sample of Brazilian population aged 16 and over (2,016 respondents, with an estimated confidence interval of 95%). The questionnaire includes 24 questions, split in three sections: (i) evaluation of the interest and consumption of information on S&T; (ii) attitudes and visions on S&T; (iii) evaluation and knowledge on the situation of Brazilian science.

The survey showed that Brazilians have a good level of interest in S&T, similar to their interests in sports or economy. Medicine and health and the environmental problem were the issues with the biggest interest. One of the survey's main objectives was to map out how the Brazilian public engages with S&T; for example, visiting scientific- cultural institutions or participating in any S&T-related event in the past year. Just 8,3% had visited science centers and museums; the figure was 4% in the 2006 survey showing a significant growing in the last four years. This number of visitors depends strongly of the social class and education. About 4,8% took part in activities of the National S&T Week (3% in the 2006 survey). Brazilians seem to have a definitely positive and optimistic view on science: about
82% said S&T brings only benefits or more benefits than harm for society. This view is general, and does not vary significantly with people's education or social class. The main concerns about the use of S&T were related to negative environmental impacts, followed by the reduction of the employment.

Quantitative surveys have obvious limitations. For instance, they supply an instantaneous picture, without mapping out key information on the dynamic process of the engagement between science and society. These studies need to be complemented by qualitative studies, providing deeper analyses of the motivations, viewpoints and reactions of selected social groups toward S&T. We will discuss also how these surveys have been used for improving public policies and for the design of more effective science education and science communication strategies and programs. For instance, results of the 2006 survey were used within the Plan of Action for Science, Technology and Innovation for National Development (2007-2010) in the establishment of programs for the creation of new science centers around the country. These surveys can also provide useful information and political inputs for improving social inclusion and democratizing knowledge.

232. Summary of the Eighth Science Literacy Survey in China

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Abstract. It has been carried out a total of eight national public scientific literacy surveys in China since 1992, and the sample number of the most recent scientific literacy survey of Chinese citizens–the 8th Science Literacy Survey was up to 69,360. The main results have been formally released after it was finished in May 2010. This paper introduced the methods of sample design, process control and data processing of the 8th Science Literacy Survey, as well as the differences from the previous surveys. The results of this survey indicated that the level of scientific literacy of Chinese citizens has increased steadily, and the ratio of the Chinese citizens with scientific literacy has been up to 3.27% by 2010. The mass media channels by which Chinese citizens use to get scientific information are becoming more and more diverse, especially the proportion of using emerging modern media such as Internet increased obviously. There were higher proportions of Chinese citizens visiting the science and technology museums and participating in science activities. Chinese citizens held positive attitude towards science and technology and in the minds of Chinese citizens, the prestige of science and technology related occupations was higher than other occupations.

233. ICT Mediated Knowledge Share Centres for Localized Extension Services in Rainfed Agriculture

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Abstract. In the present era of knowledge revolution there is a need to equip farmers with changing scenario of dynamic information acquisition, communication and utilization. ICT mediated need based location specific communication in rainfed agriculture integrates the information, communication, dissemination and adoption for sustainable agricultural development .Use of ICT's in combination with different media like TV, bulletins, posters etc,. exhibit multifaceted dimensions and multifarious roles for technology access particularly in communicating to farmers.

With this background, ICT's component is included in the CRIDA's NAIP project on "Sustainable rural livelihoods through enhanced farming systems productivity and efficient support systems in rainfed areas" which is an action research pilot project in selected village clusters of the 8 backward districts of Andhra Pradesh involving a consortium of institutions from public, private and NGO sectors. Efforts are made in the project to open the avenues for technology access and utilization in the rural areas to the clientele. Realizing the importance of ICT's in this juncture, one of the specific objectives of the project is "Capacity building and skill development of primary and secondary stakeholders through knowledge sharing, collective action and use of modern ICTs". The present note reveals how the knowledge resources in combination with media enabled ICTs are used in the project to harness technology communication and utilization by rural masses

For better utilization of the services, informal institutional set up with three tier structure i.e Information Knowledge & utilization (IKU) groups at village / grassroot level for utilizing the knowledge resources diffused

, Knowledge share Centres (KSC) at cluster level to disseminate and communicate the knowledge & information generated and Knowledge Resource centers (KRC) at apex level to generate knowledge / technology resources and content based on clientele needs assessment & Participatory rural appraisal (PRA) is being promoted under the initiative. User-friendly information through touch screen kiosks (TSK), queries readdressal system through interactive voice response system (IVRS), awareness creation of the technologies through display announcement package (DAP), Internet etc, are the services of the KSC. The KSC platform combines technologies, knowledge and multiple media such as television, print media to bring vital information regarding crop management practices, local weather, prices in local markets to communicate meaningful information & knowledge to farmers

Efforts are made in the project to provide localized knowledge as expressed by the rural community during situation analysis by PRA, focus group interactions FGI and information needs assessment INA. The content was then designed based on the PRA, INA etc, in an user friendly interactive format for crop diagnostic services, crop calendars, package of practices, weather alerts, market information etc, two years experience from the project states that media in combination with ICT's for technology transfer communication with farmers and knowledge enhancement with attributes of compatibility, profitability, amenable to local situations and regular updates of technology is need of hour for better outreach and adoption.

234. A Study on Uses of ICT in the Agriculture Field in Tiruchirappalli District *T.*

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Abstract. Agriculture is considered as primary occupation for a major segment of population in India. A vast majority of rural population depends upon agriculture. But now agriculture is in depression and needs rejuvenation. The agricultural sector in India is currently passing through a difficult phase. India is moving towards an agricultural emergency due to lack of attention, insufficient land reforms, defective land management, non-providing of fair prices to farmers for their crops, inadequate investment in irrigational and agricultural infrastructure in India, etc. India's food production and productivity is declining while its food consumption is increasing.

The ultimate solution to this problem is the use of ICT in the agriculture field at the grass root and ground level. India's food production and productivity may be increased by an effective use of ICT for agricultural purposes. The developed nations are using laser technology instead of tractors to plough lands. This helps in optimizing the use of various inputs such as water, seeds, fertilizers, etc. The problem is that Indian farmers cannot afford this technology and unless government comes in support for agricultural infrastructure, the same remains a dream only.

For instance, panchayats should encourage cooperative farming, power and irrigational facilities must be provided to the farmers, easy and effective financial access must be provided to the farmers, direct marketing and sale must be adopted by farmers, public investment in agricultural infrastructure must be enhanced, a minimum support price for food grains must be set, etc. Finally, farmers in India must use Information and Information Technology (ICT) for agricultural purposes.

Further, power and electricity also remains a major problem for Indian farmers and alternative means of power like solar energy panels, regulated and optimised by ICT, can be a blessing for them. Thus, e- agriculture can put India on the higher pedestal of Green Resolution making India self-sufficient in the matters of food grains.

Some of the benefits of ICT for the improvement and strengthening of agriculture sector in India include timely information on weather forecasts and calamities, better and spontaneous agricultural practices, better marketing exposure and pricing, reduction of agricultural risks and enhanced incomes, better awareness and information, improved networking and communication, facility of online trading and e-commerce, better representation at various forums, authorities and platform, etc. E-agriculture can play a major role in the increased food production and productivity in India.

235. Study of the Education Environment Factors Affecting the Creative Imagination of School Students in China

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Abstract. The purpose of this study is to investigate the education environment factors which either stimulate or inhibit the development of creative imagination of school student in China. The instrument was The Test of Creative Imagination which developed by our group. All participants consisted of 70 students who come from two schools sited in Cheng Du city in Sichuan province in China. Based on the findings of this study, we conclude that these strategies can improve students' creative imagination, such as inquiry based teaching; student-center; group discussion; utilizing computer in teaching. However, large amount exercises, memorizing and repeating from textbooks will destroy students' creative imagination. We also conclude that students have a certain fear as well as get supportive attitudes from teachers will be beneficial to improve their creative imagination. Sufficient books are good to students' creative imagination. Internet access has two sides' effects on creative imagination of students. We also propose some suggestions for teachers.

236. The Classics of Science in P. R. China

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Abstract. From the 1950s to the 1970s, China has experienced a Natural Science Critique Movement, which lasted more than 20 years. With the start of this movement, some classics of science were successively translated into Chinese and got published. In the 1950s, China and the Soviet Union became socialist allies. So in the field of natural science, China was strongly influenced by the Soviet Union's ideology. Therefore, how to select the classics of science followed two standards. One was to select the works which had be commended or criticized in Dialectics of Nature by F. Engels or Materialism and Empiriocriticism by V. Lenin (both books were seen as the philosophical guides of the natural science then), and the other was to be commended or criticized in the Soviet Union. At that time, these two standards were clearly reflected in the Sovietization of the Chinese college textbook. In the early 1960s, the alliance between China and the Soviet Union broke, but incredibly, Some Western classics of science became appreciated—Works of A. Einstein, E. Schrodinger, N. Bohr got published one after another, and some of them even became college textbooks. In the period of complete confrontation between China and the West, this phenomenon seems a little strange. In 1966, China launched a decade-long Cultural Revolution, in which the proletariat ideology and the bourgeoisie ideology struggled each other. Thus, in the field of the natural science, some Western theories of science were seen as idealism and metaphysics theories of the bourgeoisie. The publications of many classics of science became class struggle tools by which the Proletarian combated against the Bourgeois ideology. This situation lasted from the early 1970s to the end of 1976, when the Cultural Revolution was over.

In the 1980s of the 20th century, China entered a new period of reform and opening-up. Some classics of science had been translated into Chinese and got published since then. To respect the history, these works were required to "try to maintain the original style in the translation". In this period, the publication of classics of science began to be deideological. In the 21st century, the government of China has strongly supported the publication of the classics of science, which have been accepted as the National Key Books and subsidized by government funds. This effort of the Government, on the one hand, is trying to inherit the great cultural heritage of human history, improve the public's scientific literacy and earn the public's recognition of the spiritual values of the science, and on the other hand, is trying to speed up the reform of the college education system deeply influenced by the Soviet Union's, and urge the college education system to shift from special model to general model.

This article explored the communication history of the classics of science in China in the past 60 years, and inquired the complex relationship among the science, philosophy, ideology and education reform in China.

237. On the Children's Science Communication

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Abstract. Science communication is an emerging academic field, this paper outlines the concept of scientific communication, focusing on their science for the public to describe the spread of this side, popular science lectures in science communication in the role. At the same time the huge crowd for the primary audience, how to implement science communication and science communication from the current level of children, explain the existence of popular science lectures and commitment to be confusion problems, and to localize the actual science communication, an overview of the town school children how to carry out some of the practices of science communication.

Keywords: Science lecture, Spread

238. The Effects Assessment of "the Project on Science Popularization Benefiting Peasants and Prospering the Rural" in China

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Abstract. "The project on science popularization benefiting peasants and prospering the rural" is a new mode of popularizing science and technology for villages in China, which aims to heighten peasants' science literacy and promote the development of rural economy and society. The project has been implemented for three years from 2006 to 2008. In order to evaluate the project and its effects objectively, China Research Institute for Science Popularization has developed an evaluation index system. We explore to use a method of comprehensive grading and adopted a combination of self-evaluation and the assessment of the project group in conjunction with the experts to evaluate the effects that the project has brought about in some typical regions, meanwhile analyze the results of assessment deep.

Keywords: Science Popularization, Peasants, Rural China

239. Thoughts on Problems on the Boundary of Science Communication–From Several Examples in China

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Abstract. This article discusses some problems on the boundary of science communication in China, and also, defines a new boundary according to some characters of science communication recently. So far away from the center of science, the situation on the boundary is quite different. On the other hand, this study is not as the study about the boundary of science as well, for science and science communication are totally different topics. Science has long been the way that people deal with nature, yet science communication is related to the field of humanities. It must care about this relationship and even build on the relationship between the two to obtain the effect they want. As a result, the boundary of science is certainly complex, not as one always think. And it is worth studying, because standing in this field, it is hard to us to get the identification: whether something is science communication or not. However, What I have to emphasize is that before we gain enough achievements in examples' research, we can never imagine any regular about the boundary, we need amount of evidence. In this article, I tried to give some examples which are really on the boundary of science communication. At least I consider the situation in China is like this, and some of such examples also suit to some other countries. I believe thanks to the influence of culture, each race or culture owner must have their characteristic boundary of science communication. At the end of the article, I gave some example in detail to show some character from them. From those examples of Chinese seal-cutting, I hope to show the flexibility of science communication clearly. Furthermore I think it can support my conclusion about the boundary of science communication: its appearance is not the filament, but the glow.

Keywords: Boundary; Science communication; Science and art

240. Information Seeking Behaviour of Tapioca (Cassava) Growers in Salem District

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Abstract. This paper is an outcome of the research study conducted by the authors on information seeking behavior of tapioca growers in Salem District, Tamilnadu, India. Data were collected by using face-to-face interview method and analyzed by using the latest version of SPSS Package for appropriate statistical procedures for the description. This study discusses the findings of various strategies and procedures adopted by the tapioca growers in meeting their information requirements through different channels. The objective of the study was to ascertain the association between information seeking behavior of farmers and their personal characteristics.

Keyword: Agricultural information systems, Information seeking, Information behaviour, Information sources, Tapioca

Introduction

Information seeking is a human process that requires adaptive and reflective control over the afferent and efferent actions of the information seeker. The study on information seeking behavior includes: the strategies people adopt for making discoveries, their expectations, attitudes, anxieties, promotion of relationships as they live and work with other information users. Information seekers should begin with finding out the obstacles which deter progress, thereby creating an information gap / vacuum. An important aspect of sense making is a process in which people struggle to understand a problem that drives them to seek meaning; for in many situations and many circumstances they are content to take no such action.

Therefore the need arises to find out if the tapioca growers are able to obtain the information they need as they go about searching for relevant and pertinent information. It is also important to find out what methods and sources of information they usually utilize while trying to meet their objectives. Sequel to these reasons, the researcher also studies the information and utilization patterns among tapioca growers in Tamilnadu.

Methodology

This study involved data collection and analysis purely based on the primary sources of information available from registered tapioca growers of the factory in Salem District. The registered tapioca growers of the factory were listed and stratified into three categories such as small, medium and large scale farmers. From the registered Tapioca growers, 117 sample respondents were selected at random. The primary data were collected with the help of pretested structured schedule by holding personal interview regarding utilization of information sources, knowledge level and socio-economic characteristics of the Tapioca growers. Thus the sample consisted of farmer's observations among the factories in Salem district.

Objectives

1. To study the role of existing information sources and knowledge level of the tapioca growers.
2. To examine the socio-economic characteristics and the problems faced by the Tapioca growers.
3. To find out the problems faced by the tapioca growers of Salem district in utilizing the information through agricultural research center.
4. To find out the utilization of credit facility by the Tapioca farmers of salem district.
5. To identify the constraints and provide suggestions for improving the existing information system.

Hypothesis

1. Tapioca farmers differ in their educational status on the basis of their land size.
2. Tapioca farmers differ in their knowledge level of tapioca cultivation practices.
3. Tapioca farmers differ in their level of utilization of inter personal sources.

4. Tapioca farmers do not differ in their level of attending training programmes.
5. Tapioca farmers do not differ in the problems faced by them in utilizing the information secured from training programmes.
6. Tapioca farmers do not differ in the problems faced in utilizing information through Tamilnadu Agricultural Research Center.

Result and Discussion

Table: 1 Distribution of respondents according to the educational status

S.No.	Categories of Tapioca Farmers	Ill	Can Read Only	Pri	High	Mid	Sec	College	Total	X2	DF	LS
01	Small	14 (11.96)	4 (3.42)	8 (6.83)	3 (2.56)	5 (4.27)	4 (3.41)	2 (1.71)	40 (34.18)	64.45	12	0.01
02	Medium	12 (10.26)	3 (2.56)	5 (4.27)	4 (3.42)	4 (3.42)	6 (5.12)	3 (2.56)	37 (31.64)			
03	Large	3 (2.56)	2 (1.71)	6 (5.12)	5 (4.27)	6 (5.12)	6 (5.12)	12 (10.26)	40 (34.18)			
	Total	29 (24.77)	9 (7.7)	19 (16.24)	12 (10.25)	15 (12.82)	16 (13.68)	17 (14.54)	117 (100)			

Hypothesis: Farmers differ in their educational status on the basis of their land size. As per the table among the various groups of farmers, High School level education is found more in large farmers. Illiteracy is found more in small and medium groups. Middle level education is more in medium farmers and college level education is more in large farmers. This difference is confirmed by the chi-square (64.45) obtained, which is significant at 1% level.

Table: 2 Knowledge level of tapioca growers in cultivation practices

S. No.	Categories of Sugar Cane Farmers	SBTT Treatments	Fertilizer Application	Weed Control	Pest And Diseases Control	Inter Cultivation Practice	Irrigation Management	Total
1	Small		6		12		5	
5		4		8		40		
2	Medium	4			10		3	
5		6		9		37		
3	Large		14		8		3	
5		6		4		40		
	Total	24			30		11	16
	15		21		117			

Hypothesis: Tapioca farmers differ in their knowledge level of tapioca cultivation practices.

Calculated Chi-square Value = 19.44
Degrees of Freedom = 10
Level of Significance = 0.01

It is observed from the above table that irrespective of their farm size, majority of them have more knowledge in fertilizer application followed by SBTT treatments and weed control. But among the different groups of farmers, small and medium farmers have more knowledge in fertilizer application, but large group farmers have more knowledge in SBTT treatments. This difference is confirmed by the obtained Chi-square value, which is significant at 1% level. Hence the stated hypothesis is accepted.

Table: 3 Utilization of Mass Media Sources

S. No	Categories of Tapioca Farmers	Utilization of Mass Media Sources										Total
		Radio		TV		Newspaper		Magazines/ Journals		Films and Video		
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
1	Small	32	8	26	14	18	22	9	31	30	10	40
2	Medium	28	9	25	12	21	19	12	25	29	8	37
3	Large	26	14	23	16	24	16	21	19	25	15	40
	Total	86	31	74	42	63	57	42	25	84	33	170
		73.5%	26.5%	63.2%	36.8%	53.8%	46.2%	35.9%	64.1%	71.8%	28.2%	

It is seen from the table given above that, among the various sources of utilization of mass media majority of them receive knowledge through Radio (73.5%) followed by film and video (71.8%) and T.V (63.2%) irrespective of their land size. On the basis of their groups, small group farmers utilized radio more; large group farmers utilized radio, film and medium group farmers use radio, video more. So majority of the tapioca farmers receive information through radio, films and video.

Table: 4 Problems faced by the tapioca growers in utilizing the information obtained from training programmes.

S.No.	Categories of Tapioca Growers	No Information About source	Insufficient Time	No village Based Training.	Difficulties To Understand	Other	Total
1	Small	5	6	20	-		37
2	Medium	8	3	26	-		40
3	Large	6	5	21	-		40
	Total	19 (16.2%)	14 (12.0%)	67 (57.3%)	-		117 (100%)

Calculated Chi-square Value = 4.690
Degrees of Freedom = 6
Level of Significance = Non significant

Hypothesis: Farmers do not differ in the problems faced by them in utilizing information from training programmes.

Regarding the problems faced by the tapioca growers in utilizing the information obtained from training programmes, it is observed from the above table that, irrespective of their categories, 57.3% of the farmers have told that the training programmes are not village based. 16.2% of them have no information about source, 12.0% of them complained of insufficient time, and 14.5% of them found it difficult to understand. This difference is not confirmed by the obtained Chi-square value, which is non-significant. Hence the stated hypothesis is accepted.

Table: 5 Problems faced by the tapioca growers in utilizing the information through Tamilnadu Agricultural Research Center

S. No.	Categories of Tapioca farmers	Yes	No	Total
1	Small	28	12	40
2	Medium	26	11	37
3	Large	32	8	40
	Total	86 (73.5%)	31 (26.5%)	117 (100%)

Calculated Chi-square Value = 1.158
Degrees of Freedom = 2
Level of Significance = Non significant

Hypothesis: Farmers do not differ in the problems faced by utilizing the information received through Tamilnadu Agricultural Research Center.

It is seen from the table that irrespective of the categories 73.5% of the farmers face problems. But 26.5% of them did not face any problem. Category wise more number of medium group farmers did not face any problem. This difference is not confirmed, because it is non-significant. So the hypothesis is accepted.

Finding and Conclusion

- Out of the 117 samples selected for this study the following were the findings.
- Only large size tapioca growers have the higher level of education i.e. , high school education and above.
- One fourth of the tapioca farmers have good experience in fertilizer application when compared to the other aspects of tapioca cultivation.
- Radio, films and video programmes and TV are the media mostly used by the tapioca growers.
- Majority of the tapioca growers (66.6%) have not attended the training programmes. Only large farmers attended the training programmes.

Suggestions

1. The farmers are not having frequent contacts with the staff of state agricultural department and this should be increased.
2. There should be a regular meeting with the staff of tapioca research centre, staff of state agricultural department, tapioca officers, development officers of sago serve factory for the purpose of exchanging information on latest technology.
3. The telecasting time for agricultural related programmes should be convenient for farmers i.e., it should be after 7p.m in seasons like sowing, harvesting etc.
4. The villages concerned with the sago industries should be developed to a good extent i.e., provisions of formal education at least upto higher secondary level and also health centers.
5. The local library should be well equipped with materials pertaining to agricultural information and the farmers should be motivated to use these materials.
6. The Government should provide subsidies for the farmers who use new techniques in tapioca cultivation.

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241. Science Communication by Dialogue Through Mass Media

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Abstract. Normally science communication is taken as the dissemination of science and technology through a one way communication flowing from the author/ presenter to the target reader/audience. This limits the scope of dissemination without leaving any room for getting the doubts on the subject clarified. If the dissemination is done through a dialogue there is ample scope for the recipient of the scientific information to seek clarification and get the doubts cleared.

Having decided that the dissemination of science and technology is by a dialogue, the ways to make it a dialogue have to be explored When we start exploring the means for a dialogue, the available avenues of mass media line themselves in. Defining the mass media, various types of mass media and the mode of science communicatin as a two dialogue using these media will be discussed in this paper.

Keywords: Science communication, Two-way dialogue, Mass media, science communication Dialogue in mass media

Defining Mass Media

Mass media is any medium which is used to transit.mass communication. Presently it may be taken as the medium used to transmit science communication. Books, newspapers, magazines, recordings, radio, television and the internet all can act as a medium to transmit science communication.

The above list is not exhaustive as the new kinds of medium like mobile phone communication, video games are still evolving as the technology is advancing leaps and bounds to make these as emerging mediums in addition to the already existing mass media.

Devising A Dialogue in Mass Media

As we want the science communication to take place two-way between presenter and the target audience, readers as the case may be it has to be a conversation or dialogue. A dialogue may be ingeniously devised in all the foregoing mediums. Radio, television and internet offer easier ways of creating dialogues for dissemination of science. We are going to study in detail each of the mass media to see the roles played each of them.

Radio and Television

Radio was the foremost In electronic media carrying programmes live to the listeners. Science programmes like science snippets, science news may be aired to the listeners as a one way communication. Discussions and interviews on science topics like global warming are dialogues between participants in the programme itself. The real dialogue takes place only when the listeners directly participates in the programme. A live feed via phone may be fed into the programme enabling listeners to phone in their questions, answers and opinions on the live discussions on the programme. This way all other listeners may clarify their doubts if any as their representative lot from the listeners side participate in the conversation.

Television has taken over as the foremost medium for programmes aired via radio. The viewers get to see the participants, the interviewer, announcer, anchor all live on the television screen. Scientifically educative programmes on AIDS awareness, prevention and cure, topical epidemic like dengue fever, bird flu, super bug may all be make as programmes with viewers participation both as part of the panel and or as interacting views with live phone in to the studios.

The Internet

The internet arrived on the scene of information flow with a bang, rightly termed the information super highway providing information on every conceivable subject. Science and Technology dissemination had been never so easy after the advent of the net. Search engines spew out the hundreds of thousands of sites for disseminating science and technical information. Again coming to the two way communication, the sites disseminating science and tech may put up blogs, articles with a provision for live loading of the comments by the readers. The author then can answer any query by the readers. Even the readers may put in their expert comments if they are well versed in the subject. The beauty of net is it's accessibility anywhere any time. That makes it an excellent medium for two way dialogue of science and technology on a 24X7 basis.

The Physically Flipped Newspapers and Magazines

The newspapers and magazines constitute the print media. They are read at leisurely medium for the science communication , physically flipped by the readers. They are not live when compared to the electronic media like radio and television. When viewed as a two way dialogue medium for science communication they are less favoured. Even then the newspapers and magazines may be used to involve the readers ingeniously. The readers participation may be solicited by rewarding the best questions and best answers from them. A contest may be announced for this purpose.

The Mobile Revolution in Science and Technology Dissemination

The information dissemination received a shot in the arm by the latest entrant into the live media. Science can be compressed into a blog and article and transmitted into the hand set. The responses from the users may be Sms-sed to the original site/source. The cell phone doubles up as a internet downloader and use the medium of net as well. Like net , the cell phone medium is an anywhere anytime access/interactive medium

Science Wagons

Science wagons like the ribbon express vigyan ratha are directly reaching the people using satellite link hook-ups, audio, video, DVD aids and slide projections. What is better way than reaching the people with audio-visual aids. The AIDS awareness generating ribbon express, science programmes disseminating mobiles vans with satellite link up, audio and video aids like voice recorders, video recorders and slide projections are all live mediums directly interacting with people. Live cyclone and storm warnings, polio , family planning awareness programmes. The moving experts on these mobile platforms may interact with people educating them and clarifying their doubts

Videogames

The idea of using video games to arrive at the science communication through steps could be another ingenious way of involving the video game players who can be anyone children, young and old. Typically the game may start with a puzzle and followed by alternative routes for arriving at the solution. To encourage active participation, marks and points may be awarded the winners of the game.

Conclusion

Involvement of society in science communication is the ultimate aim of dialogue through mass media. The idea of a dialogue in science communication is to ensure the satisfaction of having participated in the discussion of scientific information. Science communication then achieves involvement of society in it's two-way journey.

242. Effective Utilization of Technological Development– **Opportunities & Challenges for the Rural Populations**

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Abstract. We are living on the era of Global village, where all the development happens in Science & Technology is well known to every citizen through Information Technology. In this context, every one living in the rural areas should get connected to the Information Technology applications; applications depending on their needs and requirements. The citizen should know how to connect, where to connect, when to connect with the available applications etc. for their needs and requirements. By considering all the aspects, this paper proposes to reduce the digital gap using the following aspects to improve their day-to-day life activities effectively for the rural masses. This paper analyses the challenges and proposes a new and novel approach of taking information technology applications to the rural more effectively.

Keywords: Digital gap, Information technology applications in rural areas

Introduction

We are living on the era of Global village, where all the development happens in Science & Technology is well known to every citizen through Information Technology. In this context, every one living in the rural areas should get connected to the Information Technology applications; applications depending on their needs and requirements. The citizen should know how to connect, where to connect, when to connect with the available applications etc. for their needs and requirements. By considering all the aspects, this paper proposes to reduce the digital gap using the following aspects to improve their day-to-day life activities effectively for the rural masses:

- Integrating the NSS / NCC students cadre / Social working Groups of nearby Educational Institutions with the rural villages
- Awareness programme about Sciences & Technology utilization like Space Satellite Applications, Medical Applications, Tele Medicine, etc., in their day- to – day life , which leads to improves Quality of their life .
- Sciences & Technological Centre for every village Municipality for people living in that areas can develop their knowledge about happening across world
- Nurturing & Grooming the school children's towards the development of Science & Technology to develop future Scientists, Social Scientists , Medical Doctors, Technocrats , etc., to strength our Nation
- More effective way of Using Mobile Technology for Information and Knowledge exchange thro Video's with experts of their need in Agriculture , Health Care with minimal cost
- Awareness about energy saving programmes

Opportunities and Challenges

The following scenarios' are faced by the villagers in rural for their day-to-day life in the Indian context

- Lack of awareness in accessing needed/crucial information
- Rural citizens are not able to know their living rights
- Lack of knowledge in development of Sciences , Technology , Health Care , etc.,
- The rural masses should travel for a long distance to the cities / State head quarters for their needs like approvals, licensing, etc., from Government department / officials - which leads to spent their valuable time

- For certain information they don't know how to approach / where to approach, dealing with departments,

  etc.,
- Indian youth has an opportunity to connect the entire world through the technological advancements.

Creating Awareness

The rural masses should be developed to the level of Global citizen, were they can lead their self-sufficient life. Rural masses should have the knowledge of all the inventions developed for the mankind applications (equipments, agricultures implements, medicine, etc.,). As a part of social responsibilities, it is our duties to expose the modern technologies applied in villages of developed countries. The awareness should be created in the following areas:

- Health care: Healthy life awareness camp in food habits (nutrition foods), first aid, Telemedicine, webinars, seminars and hygienic sanitary systems are needed/to be provided. Medical centre with medical store separately or associated with primary health centre of central/state Government which will cater the demand of medical needs. 24 x 7 dedicated medical centre for villagers medical services are also to be provided. This Panchayat Medical Centre (PMC) is to be connected with the large multi-specialty hospital in metropolitan cities as mentioned in Fig 1.

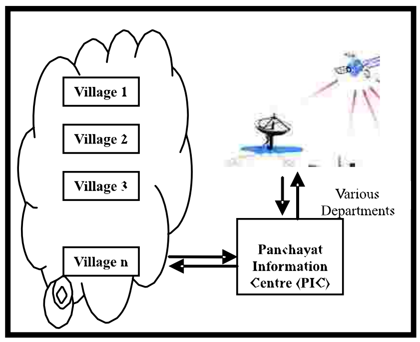

Figure 1: Connecting all villages to Panchayat Information Centre (PIC)

- Digital information through information technology: Developing information centers in one village or group of villages around five to ten kilometer surroundings is also suggested. The information centre should have Internet connectivity where all the rural masses can get the information at free of cost. Rural masses should avail the facilities like ticket booking, commodities rates, market rates for the vegetables, fruits, etc., The information centre should have facilities like Fax, Printer, Telephone, etc., and it should function 24 x 7 to serve the villagers. All the villagers should be given ATM / credit card / Debit card for online transaction to book pesticides; any make payment, etc., of their requirements. These online information facilities to be connected to the district head quarters as give in the following Fig 1.

- Satellite Communications: Information about the wealth of land in particular villages for better crop (seed nurturing) for the season to be maintained. Minerals available in that areas, etc., Disaster Information/alert should be sent to the villagers thro Panchayat Information Centre(PIC) to all mobile phone(if applicable through the regional languages of their choice) of individual people from Government Department as mentioned in Fig
  2. This Panchayat Information Centre (PIC) is connected to the Government Departments, other sources of information centers, websites, etc., through the satellites.

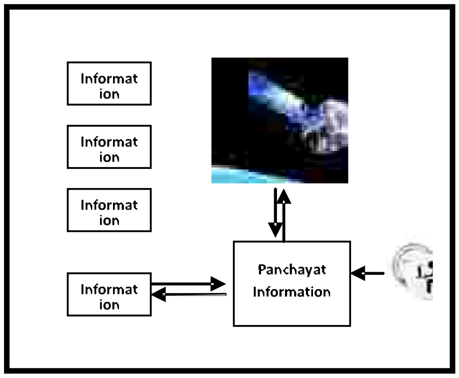

Figure 2: Networking of Information Centre

All the mentioned activities will posses the rural masses for their upliftment in their day-to-day life style.

Challenges: Approach for Creating Awareness

a. Integrating various departments

It is recommended to identify and involve the following potential groups for the collective growth of a village or group of villages involved in a panchayat.

- Departments
- Associations
- Non Governmental Organization (NGO)
- Self Help Groups (SHG)
- Educational Institutions
- Corporate

b. Roles and responsibilities

The roles and responsibilities of each participant can be given as follows;

Department: Primary health department can be assigned for health related treatment co-ordination for the villages, record of the health of each villager, etc.,

Associations: The industries association such as CII etc., for the district can be involved for purchase of equipments, etc.,

Non-Governmental Organization (NGO): The overall co-ordination of the NGO's specialized activities like (palm tree, environment, and education) can be given primary importance.

Self-Help Group (SHG): Involving SHGs like incharge of the information centre, maintaining records of each villagers, supporting the hygienic and healthy awareness programmes ,etc.,

Educational Institutions: NCC / NSS units of the educational institutions can be involved for creating awareness through camps , road shows, skit , medical shows , technology shows , etc., for Sciences & Technological awareness and happening around through mobile van, etc., Also they can arrange some camps for blood testing, eye testing, medical check-up camps.

Corporate: The major corporates can be involved by their assistance/sponsorship through technological resources which can be exempted from Income Tax.

Utilization of Technological Development–Execution of The Programmes

All the associated individuals, associations, NGOs, SHGs, NCC/ NSS of Schools and Colleges should deliver their responsibilities for the upliftment of the villagers.

Training Programmes/Workshops for the villagers for a week in the areas of

- Importance of nutrition/healthy/balanced food
- Providing purified water
- Good living conditions
- Making computer literate to apply in information centre
- Establishing Internet Browsing centers to get information across the world
- Providing need based agricultural related training
- Science and Technology Applications-serving mankind in everyday life
- Environment related activities - more tree planting through waste water/drainage water
- First Aid
- Energy saving programme like solar equipment ,etc.,
- Online certificate courses/training courses

Involving the Villagers for more action oriented towards applying Science & Technology of day-to-day life

Training the trainers programme for staff members, students in schools and colleges depending on their roles and responsibilities.

Every year the villagers can celebrate their ‘Villagers Day’ or ‘Panchayat Day’ by inviting all the Administrative Government officers, Ministers, Eminent personalities of that nativity village which will provide a platform to share their views and also they can improve upon the present scenario.

The following will be the outcome of the effective utilization of technological development–awareness campaign:

i. Individual villagers, level of self confidence will be raised

ii. They will be self starts to do the things better

iii. The programme will drive the individual’s to more productive and action oriented

iv. More awareness about life through Science & Technology

v. Knowledge sharing among villagers through this programme

vi. By utilizing the Information technology in the digital era the villagers will get the information of their need related to agricultural implements, pricing of the cultivated vegetables, Medical services, education, internet banking , etc.,

vii. The villagers can able to save more time also they will be more productive

viii. Every Individual will be proud to celebrate ‘Villagers Day’ or ‘Panchayat Day’ for the better quality of life

ix. Awareness about best practices adopted across the world

Similar programmes can be conducted every year continuously, so that the development in Science and Technology will be upgraded continuously among the individuals. The Government can also think about dismantling the Integrated departments, the roles and responsibilities can be interchanged for betterment of knowledge sharing.

Conclusion

This paper provided various measures and guidelines that can be implemented for the effective usage of technological advancements in India. The technology gap prevails among the previous generation will be reduced and the Government can drastically introduce new policies and guidelines for the technological advancement. At the end, the gap between the World and the Indian Villages in this digital era of information technology is almost bridged to the Global living standards within next decade.

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243. Workshop Science, Politics and the Media: an Initiative to **Trigger Science in the Public Agenda**

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Abstract. In the last decades, European countries realized there is a need to develop public dialogue of science not only to promote scientific culture but also to promote scientifically informed political decisions. However, the echoes of European-wide initiatives have been difficult to be heard at a national level and communication channels between scientists, politicians and journalists remain poorly established. In Portugal, a hallmark in the promotion of a scientific culture was the creation of a national agency. In addition, research institutions are starting to consider science communication strategies to engage the public with their science and their scientists. In order to discuss the role of science in the Portuguese public and political agenda, a workshop was held in April 2010. The workshop involved leading researchers, journalists, and politicians and resulted in a series of proposals and further initiatives to promote the channels of communication between these communities, such as an audience at the Portuguese Parliament and publication of opinion articles in the press.

Keywords: National level initiative, Science in the public agenda

Introduction

The European Union has been keen to implement coherent strategies for the promotion of a knowledge based society, where science has a determinant role. Despite the accomplishments of the last two decades, regular reports highlight the need to further promote public dialogue in science, as well as to develop scientifically-based decision making in global issues [1-5]. Thus, Europe has been investing in global initiatives in order to create a network of practitioners and stakeholders who shall bridge the gap between science and society at a European level (e.g. The European Union Framework Program 7 package in Science in Society). In addition, there are still significant discrepancies at national level regarding public dialogue in science.

In Portugal, an innovative initiative from the Ministry of Science and Technology has marked the last decade: the creation of Ciência Viva Agency, the national agency for the promotion of scientific and technological culture among the Portuguese population, which has been having a determinant role in the engagement of the young generations and the general public with science [6,7]. Similarly, research institutions have realized the need to come out of the social isolation they have devoted themselves historically.

In order to discuss the state of the art of the presence of science in the public agenda at a national and European level, a workshop was held in April 2010, in Lisbon, Portugal, under the title: Science, politics and the media. The workshop was organized by members of the scientific Portuguese community and gathered together leading researchers, journalists, politicians and science communicators in an open-ended public debate. The organizers aimed a two-fold intention regarding the role of science in the public and political agendas: to promote a joint reflection of Portuguese researchers, politicians and journalists on the existing channels of communication between each other in Portugal; and to transform the discussion generated into feasible outputs to increase the interaction between these three professional communities.

The Initiative

Workshop design

The workshop was divided in three main sessions, each one dedicating specifically to the:

(1) Relationship between the scientific community and the media, including the presence of science in the Portuguese media (Session 1)

(2) Relationship between scientists and politics, including the role of scientists and the media in political decision making (Session 2)

(3) Purpose and role of researchers and non researchers when communicating science (Session 3).

A panel of speakers representing the three communities was invited to kick off the discussion of each session, paving the way for discussion with the audience. Each speaker was asked to state specifically three positive aspects, three problematic issues and three possible solutions regarding the topic of the session in a 5 minutes intervention. After this initial intervention, the debate was opened to the audience.

The main points of each session were registered by a rapportteur whose responsibility was to convey and summarize the ideas discussed and present them at the workshop's closing session and in a post-workshop report.

The primarily target audiences of the workshop were the Portuguese scientific community, the media community and the political community, as the aim was to promote engagement and discussion between these three communities. Nevertheless, the workshop was open for the general public and disseminated accordingly.

A special session was organized at the Portuguese Parliament, as a result from the preparatory meeting with the deputy president of the Portuguese Parliamentary Commission for Education and Science.

Preparation meetings and dissemination

The organizers promoted a series of preparation meetings with the invited speakers, which took place during the months preceding the workshop. These meetings intended at promoting pre-workshop brainstorming discussions with the invited speakers and at engaging them with the event.

Prior to the workshop, an extensive dissemination campaign was launched to assure that the event would have a mixed audience, including researchers, journalists, editors, decision makers and politicians. This included dissemination by email to university / research institutes, social networks, advertisement in websites related to science, media, or politics; media partners; and personal contacts to key personalities. In addition, the venue was selected to be credible, public and easily accessible, to ensure a "neutral ground" for discussion.

Achievements

Preparation meetings and dissemination

There were held 13 preparation meetings between the organizers and all the invited speakers individually. The meetings promoted the opportunity for the organizers to update and discuss with speakers the most relevant issues regarding the connections between Science, Politics and Media in Portugal and abroad. This had a positive impact in the organization of the workshop itself as much as in the participation of speakers. Most importantly, preparation meetings were a major contributor for the productiveness of the discussion held at the workshop, having had a direct impact on the appearance of specific, feasible proposals. Preparation meetings allowed, for example, the identification, and subsequent invitation of relevant researchers or decision makers not previously considered by the organizers (to be present in the audience); for the maturation of ideas presented by the speakers at the workshop; and in an invitation for a special session of the workshop to be held at the Portuguese Parliament. In this session, participants met members of the Portuguese parliament, namely from Parliamentary Commission for Education and Science.

A webpage, a blog, Facebook and Twitter accounts were created prior to the workshop in partnership with associated organizations. These tools allowed raising awareness towards the workshop. By April 2010, 1093 Facebook profiles had associated to the workshop profile, in over 500 page visits and over 1000 wall posts, comments and page likes were recorded. On the day of the workshop, 80 tweets were recorded to be related to the event, which was the most commented topic in the Portuguese Twitter community.

Participants

A total of 190 people participated in the workshop, from which 150 were science related professionals such as researchers and science communicators, 32 media professionals and 8 politicians. This distribution was expected, given the topics discussed at of the workshop and the motivations for each professional group. Participants were affiliated to nearly 50 Portuguese different institutions. The majority of science professionals were senior and junior scientists; and science communicators. Media professionals were students and journalists from television, newspapers, and radio from 13 different media corporations and professionals from 5 public relations companies. Politicians included deputies, leaders and collaborators from 6 different institutions such as the Portuguese Parliament, the Portuguese government and other governmental bodies.

The creation of such a mixed audience, albeit predominantly scientifically based, was determinant to promote discussion on the views from the different professional groups. Public events with such mixed audience have not been regularly held in Portugal.

The debate

Science in the Portuguese media: The relationship between the scientific community and the media was addressed in the first session of the workshop, but its discussion extended to the other sessions.

The debate was launched by a Portuguese and a British journalist, who were asked to focus in their professional experience at their countries.

The relationship between journalists and scientists in Portugal was described as still lacking regular channels of communication. The journalists participating in the debate stressed out their difficulty in finding information about Portuguese science, as well as to have direct contacts of Portuguese scientific institutions and researchers. The recent creation of communication offices at research centers and universities was unanimously seen as a positive step forward. However, it was stressed that the number of research centers investing in these structures is still reduced. Thus, it has been highlighted the need to increase the number of communication offices at research institutions as well as the promotion of trustworthy direct relations between scientist and journalist.

In addition, in her contribution to debate the invited Portuguese journalist focused the many other difficulties that science journalists encounter, namely the incipient development of science journalism in the country.

The origins of science journalism in Portugal can be traced to twenty years ago when a restricted number of journalists and editors promoted the establishment of science sections in specific reference newspapers and other media. However, even though two decades have passed and despite the good quality of the work developed, there is still an extremely reduced number of professionals specifically dedicated to science journalism in Portugal nowadays. It was agreed there are presently only circa 20 science journalists actively working in national media covering both the activity of approximately 40,000 scientists in Portugal and science at international level. Moreover, this reduced number of journalists is not expected to grow in the future, given the negative impact of the global economical crisis in media business. On the contrary, the tendency has been towards the reduction of the number of science journalists working for media worldwide by turning them into generalist journalists. This tendency is even more deleterious in Portugal, where there has been an unprecedented burst in science, not only in quantity of scientists but also in quality of the research published in the last twenty years.

As the reversal of this shrinking tendency of science journalism in classical media is not foreseen, the participants debated on whether the initiative of science journalism should be taken up by the research community. In his contribution, another science journalist said that research institutions and universities should assume leading responsibility for science communication, including science journalism. Among the proposed initiatives was the investment in: 1) communication tools that do not imply mediation by journalists such as science blogs; 2) collaborative sites for science communication; 3) "niche" sites, as already happens in the U.K. and U.S.A. (e.g. http://www.futurity. org/).

On the other hand, the British journalist highlighted what has positively changed regarding science in the UK media in the last 20 years. She referred the positive changes in researchers' attitudes, which started to participate more actively with the media and appear now as interesting and entertaining people, as well as the strong increase in science dissemination initiatives such as festivals. Most interestingly, she refers to the disappearance of science sections in the UK media as a positive indicator of the move of science from a specific issue to become transversal to many media sections. Moreover, she highlighted the importance of science journalism in the increased participation of science in policy making and in public participation.

During the session, it was also discussed that there is still a long way to successfully promote scientific literacy of the Portuguese population. Scientific literacy was considered essential for the establishment of a true public dialogue in science-related issues. Scientists already know they have an important role in this process, but they do not know how to do it.

Most importantly, it was identified a need to work in the communication of risk and in the communication during crisis in Portugal. The existing lack of expertise to communicate risk was interpreted to result from a lack of transversal trustworthy science-based organizations, such as the Royal Society and the National Academy of Sciences in the UK, to effectively communicate risk and lobby for science in the public agenda. One proposal was that regular channels of communication should be promoted by the scientific community, so that when a crisis appears, the communication is facilitated.

It was debated that Portuguese scientists and science journalists can learn from British initiatives, namely in ways for the scientific community to have an active role in controversial issues related to science. This proactive attitude can promote a representative lobby for science views in the media. Specific examples that occurred in the UK were discussed, including the controversy on in vitro fertilization treatments and public debate on climate changes.

The role of media in science policy, in particular in funding of science was also discussed. The media can influence the promotion of hot topics in science rather than other scientific areas and this can frame science funding decisions. For example, nowadays life sciences have become an hot topic, attracting a good proportion of funding, whether other basic research areas have been left behind (e.g. plant research); and that this can be detrimental, as “we never now from where the next big discovery will come”.

Channels for scientists and politicians to communicate: The relationship between scientists and politicians was addressed during the second session of the workshop. The panel of invited speakers consisted in representatives from the three communities, namely one deputy from the Parliamentary Committee for Education, the President of the Portuguese science funding agency, a renowned Portuguese science journalist and three senior researchers of which one has already served as Secretary of State.

When launching debate, invited speakers highlighted the idea that science, media and politics are three distinct centers of power that are internally heterogeneous and have radical differences between each other in terms of authoritative criteria, language, values, beliefs, interests and priorities; that each center of power, or community, has a patronizing attitude towards the others, even though not explicit; and that the relationship between each other is ambiguous, albeit increasingly more interactive.

The absence of regular interaction between the three communities in Portugal was recognized indirectly by reference to isolated initiatives of public interaction between science and politics, such as the café scientifiques at the parliament occurring once a year (i.e. events that gather scientists and politicians to discuss a scientific topic), and to the absence of reference institutions to represent the scientific community as a whole. Thus, a major challenge has been identified as to decipher how to transform the existing, casual and often externally imposed interactions into a network of organized interactions, governing trends and co-production. In addition, it was pointed out that there are at least other two key players to consider: economic power and civil society.

The participation of science advice in political decisions or in societal issues has been well recognized by the scientific community. However, it was identified a need for this community to better acknowledge that the solutions for any societal issues are not merely scientific, but also political, economical and administrative, among other aspects.

It has also been referred that the scientific community cannot limit its participation to science advice and needs to become involved in multidisciplinary teams working on the implementation of solutions. For example, it has been proposed the creation of joint science-public policy platforms in specific areas involving a network of academia, research partners and governmental and non-governmental bodies - one such platform is being created in the area of social sciences; another proposal referred to the creation of a think tank for Portuguese science and public policy, which is currently non-existent.

On the other hand, the excessive hierarchy of political decision in Portugal was identified as a barrier to the participation of science in political decision, as well as the deficient scientific literacy of members of parliament and governmental bodies. To address these barriers, it has been proposed the investment in training and empowerment of the administrative professionals who are often those intrinsically involved in the implementation of public policy strategies. The discrepancies between the “timing of science” and the “timing of political decision” were considered also a relevant barrier to science advice in political decision: when governmental bodies request scientific or technical advice to the scientific community there is seldom a timely response, leading politicians to rely in private consultancy for advice, which is usually based in case-studies from other countries, and thus different contexts.

Regarding science policy, the discussion focused on the challenges for young scientists and how to promote proactive attitudes at the individual level. Participants have discussed whether initiative at individual level, at least for junior scientists, should occur on the level of the research institutions, which could then act to influence political power.

On the participation of the public in science policy, which was recognized to be practically non-existent in Portugal, it was proposed that it could be stimulated with specific initiatives, such as promoting “participative budgets for science”. Participative budgets have been implemented at the local level in Portuguese city halls funding and could be exported to science policy. These would imply the civil society to participate in the definition of a specific parcel of the public budget for science, for example, 5-10% of the annual budget.

Communicating science in Portugal: The state of the art of science communication in Portugal was the subject of the last debate session of the workshop. The panel of invited speakers included researchers with experience in communicating science and professionals fully dedicated to it, albeit in different settings, such as science museums and research institutions.

The recent advances in science communication in Portugal were discussed. A special focus was given on the role of the national agency for dissemination of the scientific culture Ciência Viva in the engagement of the younger generations (and the general public) in science. The essential role of the 19 Ciência Viva science centers (settled across the country) for the establishment of a nationwide network of researchers, school teachers, students and other stakeholders was recognized. Moreover, science centers and museums have been acknowledged as privileged venues for engaging the public with science because of their informal and "neutral" nature.

The role of outreach teams at universities and research centers as coordinators of the initiatives from the institutions was also discussed. Although still in a most reduced number, their existence was consensually seen as essential for the development of channels of communication between science and the public.

However, despite the recognition that there has been "a tremendous advance in science communication in Portugal in the last few years", participants recognized that "triumphalism needs to be cooled down", as there is still lack of critical mass in the field and the majority of researchers are still not committed to public accountability of science.

There were conflicting opinions on the compatibility of a successful science career with dedication to science communication activities. Whereas some participants found that successful scientists should not only perform excellent research but also engage actively in science communication, others considered that these activities hinder progression in the career in several ways. One important barrier for this was that science communication initiatives are not considered in the evaluation of researchers, at least in a clear and sound manner. The role of research institutions in the motivation of scientists was considered crucial, not only because they can create conditions for initiatives to develop, but also because they can act directly on the recognition of these activities for career progression. It was recognized by participants that although at national and international levels there are already incentives for scientists to engage in science communication, these measures are still lacking implementation at the level of evaluation. Thus, it was proposed that evaluation criteria for research projects funding and individual grants should include specifically previous science communication experience as an asset for researchers' evaluation; and that science communication experience should count towards students' evaluation in advanced training, for example, as eligible credits for the European Credit Transfer and Accumulation System implemented for higher education across Europe. The promotion of good practice among the scientific community to value participation in science communication has been said to be dependent on positive pressure from the scientific community itself. Also, it was highlighted the need to invest in professionals fully dedicates to science communication both at the policy and institutional levels.

Future Perspectives

In a Europe thriving to become a leading knowledge based economy, today the role of science is crucial, but not sufficient. Scientific knowledge needs to be appropriated by the civil society and become part of its cultural, political and economical outputs [8] . In addition, science-based policies for global issues need to become common practice not only at the level of European but also at a local, national level. Scientists, politicians and the media play determinant roles in these processes. In the workshop Science, politics and media the Portuguese scientific, political and media communities discussed existing channels of interactions between them and provided common outputs to promote these interactions.

The debate helped to discuss relevant initiatives and to identify major barriers for interaction. It became clear that there are barriers that hinder the presence of science in the public agenda which will only be overcome by a creative approach from both the media and the scientific community. It became also clear that a major challenge is to transform isolated contacts between the public political power, the media and the scientific community into a network of productive interactions; and it was clear that despite the ever growing awareness on the need to engage with the public, the scientific community needs more commitment and know how. To overcome these barriers, specific proposals were discussed such as the creation of a national think tank for science-based global issues; the development of public participation in science and the implementation of evaluation procedures that reward researchers for public engagement in science.

The Science, politics and the media workshop was in itself a rare opportunity for the three Portuguese communities to interact. Moreover, the event should be envisaged not only as productive debate but also as a starting point for additional actions currently under way, including the publication of opinion articles in specialized media; the production of a state-of-the-art report to be presented to the Portuguese Parliament; and the organization of future workshops. Thus, this workshop appears as a feasible approach to trigger science in the public agenda at the national level.

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244. The Interrelation between University’s Public Relations and Science Communication Education

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Abstract. CoSTEP is an educational organization of science communication at Hokkaido University, Japan. It implements two-way communication activities in science and technology in various areas, including the university and the society. Through such activities, we promote education and research in science communication. CoSTEP students acquire the skills required of science communicators through practices. In our program, from 2009, we have been providing our students with a project class, called “PR media project”, in which they plan and produce university’s PR magazine. Three teachers and ten students constitute the project team. We make a project proposal, interview researchers and students in the university, write articles, and edit them. The team is demanded from the university’s editorial board to interview and write the articles. The board members revise them. We frequently discuss its design and layout with a production company.

The team clarified the readership. We regarded high school students as the main target, and surveyed them. For example, we had questionnaire surveys to high school students and their parents on the open campus days and visited a high school to interview several students and teachers there. Thus, we not only publish articles about researches in the university, but introduce various aspects on the academia which the readers would like to know, and also pay attention to the design. Through the trials, we made more efforts towards producing articles and the whole magazine which were easy to communicate with the readers than the conventional ones. After immediately the publishing, we had a workshop on the magazine. Those who are interested in PR participated in the workshop and the magazine was evaluated by such third persons.

Producing university’s PR magazine incorporating science communication is not completed by mere interviewing and writing. It can be expressed by the communication activities involved mainly in five parties: the project team, the editorial board, interviewees, a production company, and readers. CoSTEP has other classes which involve university’s PR in terms of alternative media. For example a café project team is constituted by five students, and they plan and organize a science café, where a university professor is invited as a guest and makes a scientific talk followed by casual dialogue with citizens. The talk tends to be an introduction to the professor’s research in the university. CoSTEP students also prepare for the posters and fliers about the event, and distribute them widely inside/ outside the campus. In this sense, this science café can be said to be a field or media for university’s PR.

To sum up, university’s PR and science communication education are positively influenced each other. On the one hand, by incorporating some elements of university’s PR into science communication education, we can make such education that the students can learn to communicate to the public scientific matters in easily understandable ways through utilizing various media and they can improve their skills for communicating with others or stakeholders in the real society. On the other hand, by incorporating some elements or ideas of science communication, university’s PR, which has an inclination to one-way advertisement conventionally, can focus on the target, receive feedback from the readers or participants, and design effective PR by such communication in terms of various media and methods. By practicing such trials, university’s PR can evolve into “genuine public relations” which strategically emphasize on interactive communication with the stakeholders.

245. Mobile Phone Mediated Learning Among the Students of Bharathidasan University: A Study From the Perspective of Science **Communication**

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Abstract. Since we live in the new digital age, it is imperative that university students are taught life skills for this digital age. The mobile phones had become small, personal computers, providing clock, calendar, games, music player, Bluetooth connection, Internet access, and high-quality camera functions in addition to voice calls and short messaging. The 'smart phones', allow students to read pdf formats, spreadsheets and word-processed files and they are useful, in university education.

The Indian telecommunication industry, with about 584 million mobile phone connections as of March 2010 is the third largest telecommunication network in the world and the second largest in terms of number of wireless connections. The Indian telecom industry is the fastest growing in the world and is projected that India will have a 'billion plus' mobile users by 2015.

A mobile phone or mobile (also called cell phone and hand phone is an electronic device used for mobile telecommunications (mobile telephone, text messaging or data transmission) over a cellular network of specialized base stations known as cell sites.

This paper is specially designed to study the impact of mobile phone on mediated learning science communication among the Bharthidasan University students. It also focuses on the positive use of mobile phone among them. Further it studies how mobile phones become a tool to support curriculum and its personalization.

246. Community Radio as a Tool for Science Communication: Special References to Holy Cross fm, Trichy

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Abstract. Holy Cross Community Radio was launched on 26th December 2006 as a new initiative of Holy Cross College, Trichy. In the initial phases of establishment, Holy Cross Community Radio was available on 90.4 MHz frequency and the channel had eight hours of transmission (including repeat transmission) a day. It reached in and around ten kilometers of Holy Cross College. The target audience of this radio initiative was the women from Dharmanathapuram and Jeevanagar areas, which are the major slum areas in Trichy.

Community radio is a type of radio service that offers a third model of radio broadcasting beyond commercial and public service. Community stations can serve geographic communities and communities of interest. They broadcast content that is popular to a local/specific audience but which may often be overlooked by commercial or mass-media broadcasters.

Community Radio Stations are operated, owned, and driven by the communities they serve. Community radio is not-for profit and provides a mechanism for facilitating individuals, groups, and communities to tell their own diverse stories, to share experiences, and in a media rich world to become active creators and contributors of media.

In many parts of the world, community radio acts as a vehicle for the community and voluntary sector, civil society, agencies, NGOs & citizens to work in partnership to further community as well as broadcasting aims.

This paper focuses on the how the science reaches the mass through the community radio. This paper also deals with different science programmes bringing various taboos to limelight enhancing people to think rationally.

247. The Assessment of Science Popularization in China

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Abstract. This paper explores the history of the assessment of science popularization in China for ten years. It analyses the characteristics of the assessment of science popularization by several typical cases. The article considers the assessment has impacted on the development of science popularization and communication in many ways. Moreover, it has influenced many policy-making of science popularization and promoted science popularization and communication in China.

Keywords: Science popularization, Science communication; Assessment of science popularization

248. Science and Technology Journalism to Enlighten the Society: Efficacy of e-Magazine in Enlightening Children

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Abstract. Magazine reading plays an important role in young people's daily media diet. Although young people report seeking loads of scientific information from e-magazine sources, little is known about the frequency and nature of scientific information in e- magazines targeted to young audiences. Against this backdrop, this paper presents a content analysis of two science e- Magazines. This content analysis explores the presentation and content of two popular science e- magazines for children. Articles were analyzed for definition, concepts, experiments, illustrations, examples, cost effective working model guide for effective understanding, expert opinion on various complicated issues and feedback for the queries and suggestion from the readers. Analyses were also conducted to find the attractiveness and graphics explaining various concepts, readability and viewer ship of the content. Findings demonstrated that magazines contained a variety of science related topics which invited a great deal of comments and discussions in the forums. The scientific magazines taken for analysis were for young children who have started exploring the world of science.

249. Technological Temperament v/s Scientific Temperament: And Effect on our Environment

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Abstract. Current advancement in devices like computers, laptops, mobile phones etc. has changed the world completely. Today we are trying hard to increase scientific temperament but technical temperament is increasing very fast defeating the scientific approach. Today urban man became the "technology addicted", he can't take even a single step without electronic gadgets. This is definitely not showing the scientific attitude of man because excessive use of electronic devices is harming our beautiful Environment. Recent convergence and re-convergence of technology demands more careful and scientific usage. This issue is just not related to our environment but the man's psychology and health also. Nowadays people are well adapted themselves with advance technology and acquire the technical temper very well. But somehow it's not beneficial in long terms, because acquiring the technical temperament common man is ignoring the scientific one. In this paper I critically analyze how fast spread technology became a curse for awareness in common man and also go through the necessity of electronic gadgets their usage and its effects on our natural world.

250. Risk Communication in India: Emerging Perspective

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Abstract. Risk communication is important especially to the public in the form of an attractive and consumable product at times when they need it the most. At the same time, the public involvement and engagement with risk communication practices may offer a multilateral diffusion of such knowledge that empowers people with the ability to take not only informed but also analytical and rational decisions to combat and overcome the risks. Corporate sector has an added social responsibility to achieve this objective. Especially, in the emerging countries like India, a number of corporate houses, national, multinational or international are engaged in a variety of activities ranging from research and development to production and manufacturing causing a plethora of risks with multiple magnitudes. They are expected to educate the public, make the people aware and build the capabilities into them to be able to fight against hunger, drought, diseases, disasters, and superstitions with courage and self-confidence. An account on role of corporate sector in risk communication with reference to developing countries is being given in this paper; i.e. i) Creating public awareness as what a particular corporate firm does; ii) How it is going to benefit or harm the public (for example: Union Carbide Corporation, India did not inform the public about possible Methyl Isocyanate gas leak, that caused thousands of casualties in Bhopal, India on 02 December 1984); iii) Providing informal risk education to the public; iv) Solving local problems causing risks with communication inputs and management interventions; and v) Improving the quality of their public relations and promotional programmes, etc. The paper discovers a range of issues and problems concerning corporate sector and risk communication and identifies certain possible solutions.

Communicating Risk

Risk communication is generally attributed to the interactive process of exchange of information and opinions amongst individuals, groups, and institutions concerning a risk or potential risk to human health or the environment. Risk communication can vary from environmental communication and safety communication to health communication. It can involve care communication (which relates with awareness), consensus communication (which relates with preparedness), and crisis communication (which relates to actually dealing with crisis). Risk communication includes environmental, health, disaster and other issues causing any risk, threat, crisis, conflict or uncertainness to mankind.

For example, over 80% diseases are caused by unpotable drinking water and millions of people are dying every year from petty diseases, such as, diarrhea and jaundice, etc., which are curable, but there are hardly any effort to educate people about the risk involved in taking dirty drinking water. Surprisingly, neither scientist seems to be eager to solve this problem, nor the media shows intention to cover such issues, as perhaps these cannot fetch handsome research grants or make media headlines. As a contrast, if you talk about so called dreaded diseases and high end cutting edged technologies, you are likely to get attention from all around! Dealing with such communication risks seems to be a great challenge. Similarly, sometime unnecessary media hype gives a different perspective. In case of foot and mouth disease outbreak in USA and some other countries, media gave it undue hype, though, as a matter a fact the disease was limited to cattle only and there was no risk for human health.

Social Responsibility of Industry and Corporate Houses

The industry and corporate houses generally use common natural resources like air and water directly or indirectly for running their businesses. Besides their commercial interests, they are responsible for the welfare of the society that includes educating public about the work they are doing. It would help create better understanding between the firm and the society leading to enhanced cooperation and minimizing risks. The industry is not only responsible to educate their employees about possible occupational hazards but also it must shoulder the responsibility to educate and prepare the residents of the locality to be able to cope-up with possible disaster due to any fault in the industry.

Had the Union Carbide, India educated the public about the lethal effects of Methyl Isocyanate (MIC) gas and simple precautions, the life of thousands of people could have been saved. Simple information could have done wonders. A wet towel or any wet cloth can save life if it is put over the mouth and nose in the event of leak of MIC gas. Since MIC gas is soluble in water, it will be absorbed in the wet towel and will help reduce ill effects of the killer gas. Most of the people were became victim of the gas because they ran in the same direction in which gas was flowing.

Had they gone in opposite direction, they could have been in a better position. The industry must not escape from its social responsibility, especially when it comes to life and death of the people. It is an advantage, if the people are educated about other related subjects also.

Solving local problems of public importance with communication inputs and management interventions is equally important for the state, public and the industry, as in most cases we find industry at the backdrop of a problem. Often, local scientific or technological risk issues do not find place in mass media. It is worth noting that there has been considerable success in addressing local issues/ problems/ technologies through local/ regional level science journalism involving and motivating industry. An example is noteworthy here. In a workshop on risk communication for media persons at Rampur, India, a group of journalists discovered during the course of preparation of their story as an exercise of on the spot reporting that untreated effluents from Kashipur and nearby industries were being discharged in the Kosi River. Animals died as a result of drinking the polluted water of the river. Even trees and plants did not survive. Moreover, the ingress of polluted river water in the wells of the nearby 60 villages rendered water unpotable. This group of reporters made a thorough investigation of this problem during the course of the workshop. Specimens of polluted water were collected and analyzed. When the reports appeared in media, the authorities and industries were alarmed and forced to take a number of measures to solve the problem. This is how such local level risk reporting can help bring to the fore the local problems and help address the same.

Corporatization of Media and Communicating Risk

Media is considered to be the fourth estate of power especially in a democratic setup, like India. The advent of latest Information Communication Technology has opened new vistas of global or transnational exchange and access of media flooded with ample amount of international news and information lacking sufficient local and regional news coverage. At the same time, there exist countries that are not blessed with the power of democracy and hence may not be able to enjoy the power of fourth estate. In the circumstances, it is not only difficult to get the news but also to access them from outside the country. In case, someone succeeds in getting this censored or cooked-up news through unlawful sources, it leads to the next level of complicacy, as this news may not be authentic. It so happens, especially in case of coalmine collapses or similar disaster takes place. In such cases, the accountability of the source cannot be beyond doubt.

The primary function of media was to inform and educate public about the day-to-day happenings all around but now the primary function of media has become to sell audiences to advertisers. The media does not make money from subscriptions. Any TV News Channel does not make money when you turn on your television; they make money when an advertiser pays them. Now advertisers pay for certain things. They are not going to pay for a feature on risks of environmental degradation or a discussion that encourages people to participate democratically and inculcate a scientific bent of mind and rationalism. Unfortunately, the media houses further encourage the corporatism in a multinational business atmosphere that has a number of emerging commodities and pro-corporate concepts to sell to the audience.

The state of the Internet right now is rather like the state of the electronic media back in the mid 20th century. In most countries, radio or a large part of it was handed over to the public interest. Radio was mostly handed over to big corporations despite struggle by Church and other groups. Later, with television, there was no struggle at all. Now, we have the Internet. Like all the rest of modern technology, the public funds it. Even with print, there was a large, independent press in both England and the USA earlier this century. In England, it was on the scale of the commercial press. They were gradually taken over by corporate power. Even in developing countries like India, big corporate houses that mainly have their commercial objectives generally run the press and media and science, technology, health and environment stories for them is a tailpiece affair.

Risk of Commercial Compulsions

It has been a growing belief that only things having commercial and economic viability will sustain in today's fast advancing world that is governed and influenced by commercial and economic factors. The issue of increasing influence of commerce on scientific research and development and problems arising thereof has been the focus of discussions at various forums recently that causes risk concerns the world over. Things have even reached the point where commercial compulsions are making fundamental changes in the way risk issues are handled, and in the way, it is communicated. A step ahead, the efforts directed towards dealing with risk communication also tend to face the similar challenges and therefore it cannot be seen in isolation.

In a business driven society, if a corporate house is spending a couple of million of currency on public relations, it knows how to package things so as to overcome public opposition and change public attitudes and psyche to be able to sell their concepts and not the concepts important for risk preparedness. It seems to be rather unfair to expect such corporate owned media houses to realize their responsibility towards risk communication. Increased media globalization nowadays is overwhelmed with corporatism that has only objective of income generation, leading to a state of obscurism away from pragmatism.

Investigative Approach

The risk communication is chiefly limited to describing various aspects of a particular risk, either in a descriptive manner or some precautions for it. A number of multinational and foreign companies are opening their research centres in developing world because of availability of comparatively low cost resources and manpower. These corporate research centres range from pharmaceuticals, biotechnology and information technology to agriculture, etc. To bring public awareness about certain risk factors, there is a need for investigative journalism in this field. Whether safety measures have been taken, is there chance of any possible disaster or hazard, how the anticipated research is going to benefit or harm, is there any environmental threat to water bodies, animals or plants, are some of the questions which could form part of investigative reporting. Whatever is happening in this field, good or bad, proper or improper must be brought before the people. This form of communication is attractive in its own way and retains readers' interest in the article to read further. Normally, a journalist publishes an article after a thorough investigation on political, social, or an economic issue. This aspect, however, is largely absent in the case of scientific, health and environmental topics.

The various forms of risk communication become clear only when aspects like proper or improper uses of science and technology and good or bad impact of the same on society are brought to the fore. Risk reporting then will develop into a form of an alert guard and adviser, say, the case of introduction of new technology, genetically modified food, CNG fuel, and so on. It is necessary to realize that investigative journalism does not imply investigation of any irregularity alone or projecting something sensational, but brining to the people those useful information also still not known far and wide.

Emerging Concerns

The concerns have been expressed from across the country on different occasions on different risk issues and aspects. For example, a multinational organization was involved in a research project on Aides egypti, which causes a yellow fever, but not in India. On investigating the relevance of this research, it came to fore that the company had some hidden objectives. The worldwide scoop was published in the media and the project was closed as a result. Similarly, here is an interesting case as how the world came to know the nuclear programme of a country! There were consecutive global tenders for a device used in nuclear operations, a system that keeps the critical mass separate, and a catalytic converter after an interval of some period. A vigilant journalist was able to connect the link of these tenders and found the truth and reported in media.

There could be some very strange risks associated with the social systems and traditions. In India, in Maharashtra state, people objected to installation of wind mill farms with a mis-belief that if wind mill will extract the oxygen from air while producing electricity, how they will breathe! Similarly, according to a scientist in a neighbouring country, a parliamentarian has made a proposal to the government to capture the evil spirits and put them to work, thereby solving country's energy problem. A number of risk issues are emerging out of unlawful practices of food adulteration, cases of spurious liquor, over claims by advertisements of consumer goods, insufficient trials by pharmacy companies, and genetically modified foods, etc. The public needs to be made aware of the risks involved in such activities.

Conclusion

As the 'information age' rapidly progresses and if we want to direct it towards 'knowledge age', we need to develop the potential at foundation level to foster and support appropriate synergistic and imaginative combinations of disciplines. Improving quality of public relations and promotional programmes of risk oriented organizations is yet another area of great concern and needs to be addressed. Most corporate houses have PR and Promotional departments; generally, their main task is image building of the organization and propaganda to sale its products. These departments can be augmented and oriented in a way to be able to communicate risks to the public including their activities and scientific aspects of their services and products. It has been observed that the press releases and hand outs issued by these groups are generally not up to the mark or media friendly. Risk communication should be looked as the collective responsibility of scientists, communicators, states, social activists and workers, etc., and cannot be pursued in isolation.

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251. Mentoring as a Model for Professional Development of Science Journalism Networks in Africa. The SjCoop Project (2006-2009)

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Abstract. Professional standards of journalists who report on medical science, health and environmental science issues in Africa are largely undefined and unsupported by local associations or umbrella organizations. While human rights, HIV/AIDS and lately climate change reporting has understandably been the focus of many professional development courses, workshops and texts, this emphasis has largely been absent in guidelines and continuous training in science journalism both at the academic level and in professional practice. This paper examines the role of one model of peer-to-peer distance mentoring combined with yearly encounters with industry professionals in the development of science reporters in Africa, notably Kenya Cameroun, Rwanda and Uganda; their ability to expand and ameliorate reportage on science, health and environment in local media and to form their own professional associations and so broaden the base of science communication among scientists and journalists. Is this a sustainable theoretical model? (UNESCO for example tried to develop a science journalism program for developing countries in 2006 but this was discontinued.) Scholarship on norms of mentoring is extensive in institutional, educational, business and industrial settings but sparse in crosscutting journalism studies. Consequently, mentoring theory as applied to appropriate development, and sustainable values in emerging knowledge societies is largely absent from the discourse on science communication and non-academic science journalism education. This paper is based on an analysis of the mentoring model emerging from materials compiled over the course of a three-year program in peer mentoring, SjCoop, (2006-2009) developed by the World Federation of Science Journalists.

252. Europlanet Nodes–Promoting Planetary Science Across European Borders

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Abstract. The Europlanet Research Infrastructure links more than 100 teams working in planetary science, in Europe and around the world. The project aims to develop synergies with the ultimate goal of a better knowledge of our Solar System. It is co-funded by the European Union under the Seventh Framework Programme. Europlanet's outreach programme aims to build channels of communication between the planetary science community and the public, the media and stakeholder groups such as politicians and industrial partners. Outreach activities are based around a network of national nodes that share experiences, spread news and promote planetary sciences at a local, regional, national and European level.

253. An Extended Weighted Classification Technique using Emerging Patterns and Feature Ranking for Breast Cancer

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Abstract. Decision Tree (DTs) classifier is most important and powerful solution of classification methods. One of the major problems in DTs is that they were built using crisp classes assigned to the training data. In the existing systems this drawback gets override with the concept of Emerging Pattern (EPs). Emerging pattern are those itemsets whose support in one class is significantly higher than their support in other classes. Hence DTs classifier are generalized along EPs so that they can take into account weighted classes assigned to the training data instances .The WDTs classifiers compared with other classifiers and proved that this methods have excellent noise tolerance and good performance. In the proposed system a new weighted decision trees classifiers is constructed using EPs and is compared with weighted Decision tree by applying Fuzzy feature ranking algorithm. Feature selection aims to reduce the dimensionality of patterns for classification by selecting the most informative instead of irrelevant and/or redundant features. In this paper, fuzzy feature clustering is proposed for grouping features based on their interdependence and selecting the best one from each cluster. Feature ranking is determined by means of different criterion functions. The accuracy and speed of both classifiers are evaluated, this comparative evaluation outsource which classifier has best performance.

Keywords: Classification, Decision Tree, Emerging Pattern, Feature Ranking Method

Introduction

Emerging pattern

Decision tree classifier is considered as effective classification technique despite of their simplicity. However, DTs assume that each training data instance is related only to one class (a crisp class). That is, the calculation assumes that each training data instance is related completely to one class only. This assumption conflicts with the fact that most real life datasets suffer from noise. That is, a training instance might not always be assigned to its real class. The notion of weighted classes is proposed in previous research [1]. Assume a dataset consisting of three classes: C1, C2, and C3. An instance i is said to have a crisp class if it is assigned completely to one of the three classes. However, instance i may still have some relations with the other two classes. The notion of weighted classes indicates that i is related to the three classes with different weights. Figure 1 shows examples of a crisp class and a weighted class. In the crisp class, 100% of the weight of instance i is assigned to one of the three classes (in this example, class C1). In the weighted class, the weight is distributed among the three classes. The weight assigned to each class is proportional to the strength of the relation between this class and instance i.

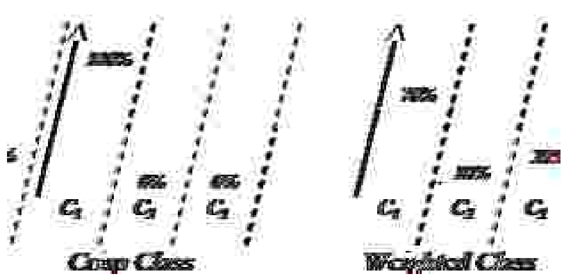

Figure1. Examples of a crisp class and a weighted class [1]

In this paper, the concept of weighted class is assigned to the DTs. Our weighting scheme, proposed in [1], is based on emerging patterns [EPs]. EPs pattern introduced in [3].They have been proved to have a great impact in many applications [4] [5] [6] [7] [8] [9]. EPs can capture significant changes between datasets. They are defined as itemsets whose supports increase significantly from one class to another. The discriminating power of EPs can be measured by their growth rates. The growth rate of an EP is the ratio of its support in a certain class over that in another class. Usually the discriminating power of an EP is proportional to its growth rate.

Fuzzy feature ranking

By now, many applications have been introduced in which, feature selection is utilized as a preprocessing stage for classification. This process speeds up both the training and reasoning stages, reduces memory space, and improves classification accuracy. Reducing the cost of gathering data is another advantage of feature selection. Small number of samples narrows the acquirable knowledge. Hence it reduces the probability of correct reasoning whether a specified feature effects on the class label or not. Moreover, a classifier can generate the classification rules more easily with small number of features. But increasing the number of features may lead to ambiguity in training so that it would not even converge.

In addition, the more features, the more processing time and memory space is needed. But a few influential features are usually adequately used in classification of samples. Indeed:

The class label is usually independent of the most of features. Some features may be correlated and selecting only a few candidates seems to be sufficient for classification. Fuzzy feature clustering is proposed for grouping features based on their interdependence and selecting the best one from each cluster.

The next section describes previous work of Emerging Pattern and Feature Ranking method. In section 3, Experimental evolutions on dataset are demonstrated. Finally section 4 deals with conclusion.

Related Work

Weighted classifiers

The shortcomings of normal classifiers were Unrealistic Weight, Sensitive to noise, Low Accuracy, Dependent on distance metric. These problems are rectified by most sophisticated and effective method (for weighting the training instances) Emerging Patterns. Initially EPs is defined as follows: $X = \{a_1, a_2, a_3, \ldots a_m\}$ is a data object (instance) following the schema $\{A_1, A_2, A_3, \ldots A_m\}$. $A_1, A_2, A_3 \ldots A_m$ are attributes and $a_1, a_2, a_3, \ldots a_m$, are values related to these attributes. Each pair (attribute, value) is denoted as an item.

Let Z denote the set of all items in an encoding data set D. Itemsets are subsets of Z. Consider an instance Y contains an itemset X, if $X \subseteq Y$.

Definition1. Given a data set D and an itemset X, the support of X in D, $s_D(X)$, is defined as

$$s_D(X) = \frac{count_D(X)}{|D|}$$

where $count_D(X)$ is the number of instances in D containing X.

Definition2. Given two different sets of data D_1 and D_2, where instances belong to class C_i, let $s_i(X)$ denote the support of the itemset X in the data set D_i. The growth rate of an itemset X from D_1 to D_2, $gr_{D_1 \to D_2}(X)$, is defined as

$$gr_{D_1 \to D_2}(X) = \begin{cases} 0, & \text{if } s_1(X) = 0 \text{ and } s_2(X) = 0 \\ \infty, & \text{if } s_1(X) = 0 \text{ and } s_2(X) \neq 0 \\ \frac{s_2(X)}{s_1(X)}, & \text{otherwise.} \end{cases}$$

Definition3. Given a growth rate threshold $\rho > 1$, an item set X is said to be a ρ-emerging pattern (ρ-EP or simply EP) from D_1 to D_2, $gr_{D_1 \to D_2}(X)$ >= ρ.

When D_1 is clear from the context, an EP e from D_1 to D_2 is called an EP of D_2, the support of e in D_2, $s_{D_2}(e)$, is simply denoted as the support of e, s(e), and its growth rate from D_1 to D_2, $gr_{D_1 \to D_2}(e)$, $gr(e)$, is denoted as growth rate of e, As stated above assume that we have a set of n training instances $T = \{i_1, i_2, \ldots i_n\}$ [redacted] classes, $C = \{C_1, C_2, \ldots C_k\}$. We have a set of EPs mined for each class, such that E_{cj} is a set of EPs related to class j. The support of an EP $e \in E_{Cj}$ is $s_{Cj}(e)$. The growth rate of an EP $e \in E_{Cj}$ is $gr_{Cj}(e)$. The strength of an EP $e \in E_{Cj}$ in class C_j, $\alpha_{Cj}(e)$, is defined as follows:

$$\alpha_{Cj}(e) = \frac{gr_{Cj}(e)}{1 + gr_{Cj}(e)} * s_{Cj}(e)$$

where $\alpha_{Cj}(e)$ represents the contribution of $e \in E_{Cj}$ in class C_j. This contribution is proportional to both the growth rate (discriminating power) of C_j and its support in the home class C_j, $s_{Cj}(e)$ .Notice that an EP might have a high growth rate and a low support in its home class and, as a result, its strength will be low. Alternatively, an EP might have a low growth rate and a high support in its home class, again resulting in low strength. That is, in order for an EP to be strong, it has to have both high growth rate and high support.

The overall contribution of EPs contained in an instance $i \in T$ of class C_j, $\beta_{Cj}(i)$ is found by aggregating the contributions of these EPs [10].

$$\beta_{Cj}(i) = \sum_{e \in i,\, e \in E_{Cj}} \alpha_{Cj}(e)$$

The aggregated value, $\beta_{Cj}(i)$, presented in above equation cannot be directly used as a weight for a training instance. The reason behind this argument is that the number of EPs may differ from one class to another. As a result, the class with the largest number of EPs will have the highest aggregated value. To overcome this problem, the aggregated values of instances in a class are divided by the median aggregated value in the same class. This division balances the aggregated values of an instance in the different classes. That is, a large number of EPs in a class will not substantially bias the final weight toward this class. The weight of a training instance $i \in T$ in class C_j, $w_{Cj}(i)$ is defined as follows:

$$w_{Cj}(i) = \frac{\beta_{Cj}(i)}{Median_{Cj}}$$

where $Median_{Cj}$ is the median of the aggregated values above equation in class C_j.. The weight is calculated for each training instance in each class. The weights of each training instance are normalized so that their sum is equal to 1. The normalized weight of a training instance $i \in T$ in class C_j, $\delta_{Cj}(i)$ is defined as follows

$$\delta_{Cj}(i) = \frac{w_{Cj}(i)}{\sum_{j=1}^{k} w_{Cj}(i)}$$

The normalized weight represents the strength of the relation between an instance and a class. That is, it represents the weighted class for this instance.

Weighted Decision tree are constructed by this weighting scheme. After applying the above weighting scheme on data instances, these instances will change from crisp classes where every instance is assigned completely to one class to weighted instances where the weight of each instance is distributed among different classes

Featured ranking procedure

Existing feature selection/ranking techniques are mostly suitable for classification problems, where the range of the output is discrete. These techniques result in a ranking of the input feature (variables). The approach exploits an arbitrary fuzzy classifying of the model output data. Using these output classes, similar feature ranking methods can be used as for classification, where the membership in a cluster (or class) will no longer be crisp, but a fuzzy value determined by the classification. The Sequential Backward Selection (SBS) search method is proposed to determine the feature ranking by means of different criterion functions.

Feature selection methods are of two main types: Feature selection and ranking methods [1]. The methods of the former type determine which input features are relevant in a given model, whilst the ones of the latter type result in a rank of importance. Feature ranking methods can be considered as preprocessing of feature selection, because relevant features can be selected by taking the first k elements of the head of the feature ranking, and then, by optimizing the number of k, e.g. by a trial-and-error procedure. The method aims at providing a reliable feature ranking method for weighted classifiers.

A fuzzy classification method divides the clustered space into various regions, called clusters, and determines a vector of membership degrees for each data, which indicates the grade to which the particular data belongs to the clusters. Because clustering is only in the way of one dimensional output, the shape of the clusters (e.g. spherical or ellipsoid) is irrelevant, due to the fact that in our case clusters are interval.

The feature ranking on fuzzy clustered output (FRFCO) algorithm [11]

1. Let $\mathcal{F}_0 = \{f_1, \dots, f_N\}, k = 1$
2. For all $f_{\mathrm{temp}} \subset \mathcal{F}_k$.
   (a) Let $\mathcal{F}_k = \mathcal{F}_{k-1} \setminus \{f_{\mathrm{temp}}\}$,and update matrix X by deleting temporarily its f_{temp} th row, and vectors f_{temp}
   $\underline{v}_i$ (above equation) and $\underline{x}$ by deleting temporarily $J(X_{\mathcal{F}_k})$ th element.
   (b) Calculate matrices $Q_b(X_{\mathcal{F}_k}), Q_w(X_{\mathcal{F}_k})$ and determine .
3. Let $f_{\mathrm{perm}} = \arg\min_{f \subset \mathcal{F}_{k-1}} J(X_{\mathcal{F}_k})$ i.e. where J attains its minimal value. The final $\mathcal{F}_k$ is obtained f_{perm} by deleting permanently the variable from $\mathcal{F}_{k-1}$, and then update expressions X, vi and x appropriately.
4. If $k < N$ then back to step 2, else stop.

The order of the deleted variables gives their rank of importance.

Remark1. Note that f_{perm} can contain more than one variable. In such a case we delete all of them at a time. The Feature ranking algorithm is an instance of SBS search method. In our application, SBS method applies the interclass separability criterion function. This method has two advantages. Firstly, it has more stability and faster convergence due to fuzzy clustering; secondly, it improves the accuracy of the classifier using the selected features.

In the ith step, temporarily a variable is f_{temp} ($f_{\mathrm{temp}} \subset \mathcal{F}_{k-1}$) deleted , so that feature set $\mathcal{F}_k = \{f \mid f \subset \mathcal{F}_{k-1}, f \neq f_{\mathrm{temp}}\}$ and input matrix $X_{\mathcal{F}_k}$, where the starting feature set is $\mathcal{F}_0 = \mathcal{F}_N$, and then calculate the matrices $Q_b(X_{\mathcal{F}_k})$ $Q_w(X_{\mathcal{F}_k})$ and to be used in the criterion functions. This procedure is repeated for all the variables in $\mathcal{F}_{k-1}$. By means of an appropriate criterion function, the expression $\min J(X_{\mathcal{F}_k})$ attains its minimum when the deviation between Qb and Qw is the least, i.e. when the most important variable $\subset \mathcal{F}_k$ omitted. Then we remove the selected feature $\mathcal{F}_k$ permanently, and then restart the algorithm with the updated feature set . The algorithm ends when the cardinality of the feature set is 1.

Experimental Evaluation

Weighted classifiers

In this section, weight is assigned to dataset using emerging pattern, and then weighting scheme is applied to classifiers. Then Weighted Decision classifier (C4.5), and Weighted DT with Emerging Pattern, Weighted DT with Emerging Pattern are compared. The experimental evaluation is on two datasets from UCI repository of machine learning databases. .The accuracy is obtained by evaluation these algorithms respectively on datasets.

Fuzzy feature ranking weighted classifier

Feature ranking is applied on Weighted C4.5 classifiers. The accuracy of classifiers is compared.

Accuracy comparison between Weighted Decision tree (WDT), Weighted Decision tree Emerging Pattern (WDT-EP) and Weighted Decision tree Emerging Pattern Feature Ranking (WDT-EPFR)

Table 1. Breast Cancer dataset taken from UCI Repository has 9 Attributes, 286 Instances

No of Records	WDT	WDT-EP	WDT-EPFR
50	97.6	97.8	98.1
100	98.1	98.3	98.5
150	98.8	98.9	99.0
200	99.4	99.5	99.7

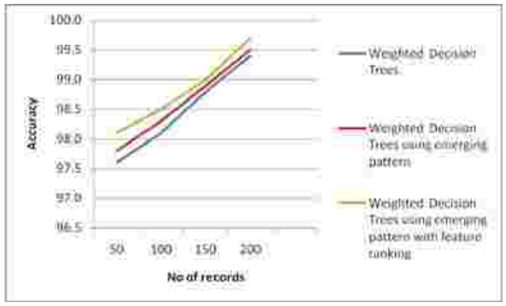

Figure 2. comparison of Classifiers accuracy WDT=99.4, WDT-EP=99.5, WDT-EPFR=99.7 (Beast Cancer)

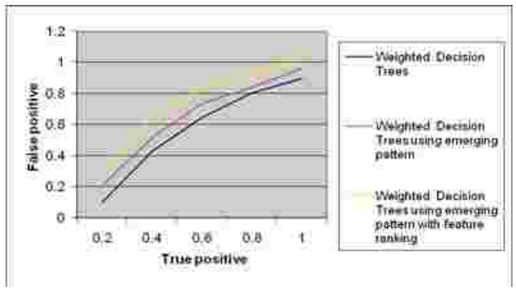

Figure 3. ROC Curves of WDT,WDT-EP and WDT-EPFR (Beast Cancer)

Table 2. Breast Cancer Wisconsin dataset taken from UCI repository has 32 attributes, 569 instances

No of Records	WDT	WDT-EP	WDT-EPFR
100	78.2	79.3	80.2
200	79.3	80.4	81.3
300	80.2	81.3	82.2
400	81.3	82.2	83.0
500	82.1	83.0	83.7

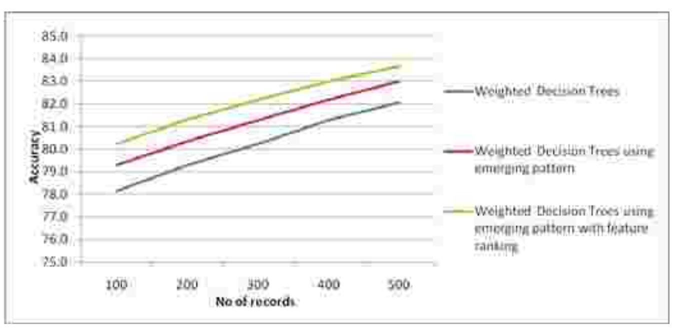

Figure 4. Comparison of Classifiers Accuracy
WDT=82.1, WDT-EP=83.0, WDT-EPFR=83.7 (Breast cancer Wisconsin)

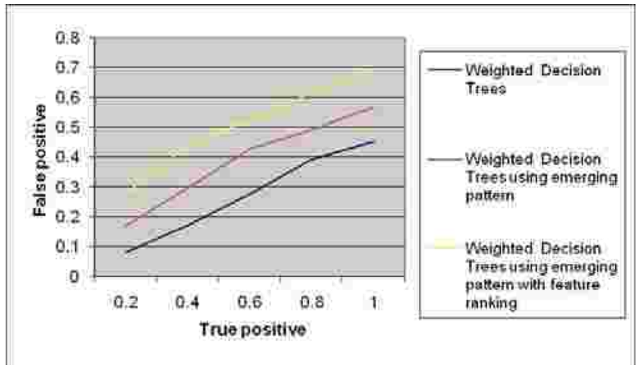

Figure 5. ROC Curves of WDT,WDT-EP and WDT-EPFR (Breast cancer Wisconsin)

Speed evaluation

Execution time for Fuzzy Featured-Weighted Decision tree using Emerging patterns classifier is measured in Table 3.

Table 3. Speed Measurement

Data Set	
Speed Breast Cancer	
17.65/ms Breast Cancer Wisconsin (prognostic) 62.96/ms	

Receiver operating characteristics (ROC)

Receiver Operating Characteristics (ROC) curves is a helpful method for visualizing the performance of classification. ROC curves are plotted on two-dimensional graphs. The X axis represents the true positive rate (TPR) and Y axis represents the false positive rate (FPR).The ROC curves show that WDT-EPFR has better performance than WDT-EP.

Conclusion

From the parameter comparison among two datasets it is concluded Weighted Decision tree with Emerging Pattern and feature ranking algorithm has better performance (accuracy) than Weighted Decision tree algorithm. In future, accuracy can be improved using partitioning algorithms.

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254. BCDI–Communicating Bamboo Science and Technologies

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Abstract. The bamboo and cane crafts occupies important role in the economy of North East Region and is also one of the largest employment provider in the region. The demand for these eco friendly crafts is huge both in the domestic as well as in the international markets. However despite huge production base the products are not sold well due to lack of technology and product development as per the growing consumer preference. Development Commissioner (Handicrafts), Ministry of Textiles, Govt. of India with an objective to fill up the gap in the area of Design and Product Development initiated setting up of Bamboo and Cane Development Institute (BCDI) in 1974. National Centre for Design and Product Development (NCDPD) has been entrusted with the responsibility of running and management of BCDI by O/o. Development Commissioner (Handicrafts) with an objective to professionalize the efforts in an effective manner. NCDPD is all set to run BCDI in a professional manner with an objective to project BCDI as a centre of excellence for Cane and Bamboo. The Technology Centre and Training is being initiated on priority. The centre seeks improvement in the competitiveness by upgrading the technology of production targeted to bamboo and cane manufacturers. Creating and promoting sustainable supply chain management and project India as one of the lead suppliers of eco friendly and greener crafts. Following are the current activities for technology dissemination:

Capacity/Skill development programme: is initiated with an objective to educate and upgrade the knowledge of artisans/craftpersons/entrepreneurs of bamboo handicrafts. A well structured course curriculum is structured where the participants get aware regarding technology, design, product development and marketing.

Integrated Design and Technical Development Project on Bamboo and Cane: The main objectives are to provide new and innovative designs and improve the technical skills of the artisans thereby produce market acceptable products. Beneficiaries of this workshop are the artisans/craftsmen engaged in Bamboo and Cane crafts.

Bamboo Technology Centre: A state of the art technology centre is being set up at BCDI, Agartala to provide the necessary technical information and practical hands on training to the Artisans and craftspersons engaged in the Cane and Bamboo Sector. This centre will also facilitate industry oriented training programme.

Bambusetum: facilitates for educating the artisans, visitors and students regarding different bamboos, their characters, properties and identification etc.

In house publication: ‘The Enquirer’ quarterly news letter for information regarding technology, design and product development. ‘Design Excellence 2010’ is a compilation of various designs for cane and bamboo product lines. “Know Your Bamboo” a simple book in three languages i.e. English, Hindi and Bengali. It contains information regarding bamboo diversity, propagation, management, seasoning and methods of treatments.

Associations: with INBAR for transfer of technology, training, global market linkages and other areas. BCDI and Tripura University (A central university) signed a MoU for one year PG Diploma on Bamboo cultivation and resource utilization.

Keywords: Handicrafts, Technology, Training and education

255. A Wireless Sensor Network Simulator: Wish

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Abstract. In many cases it is impractical to experiment on real wireless sensor network systems; there are several reasons for this. First, a proposed hardware platform, while theoretically possible, may not be manufactured. An example of this is a low power system-on-chip hardware platform that, while possible, is not yet practical to manufacture due to up-front design, mask, and fabrication costs. Second, even if the hardware platform exists, it may be prohibitively expensive. Hence simulators are built , many of these simulators are designed for other types of networks; for instance, wired TCP/IP networks. Others, though wireless, are made to simulate WLAN networks and 802.11 protocols, and are also inherently IP networks. Also, some simulators that are designed specifically for sensor networks are limited to a specific programming environment. We introduce Wish ; a wireless sensor network simulator designed to address these problems. Wish is built from the ground up to simulate sensor networks. Wish is efficient; it scales to simulate networks with thousands of nodes faster than real-time on a typical desktop computer. Wish is component based and easily reconfigurable to adapt to different: levels of simulation detail and accuracy; communication media; sensors and actuators; environmental conditions; protocols; and applications. In many cases it is impractical to experiment on real wireless sensor network systems; there are several reasons for this. First, a proposed hardware platform, while theoretically possible, may not be manufactured. An example of this is a low power system-on-chip hardware platform that, while possible, is not yet practical to manufacture due to up-front design, mask, and fabrication costs. Second, even if the hardware platform exists, it may be prohibitively expensive. Hence simulators are built, many of these simulators are designed for other types of networks; for instance, wired TCP/IP networks. Others, though wireless, are made to simulate WLAN networks and 802.11 protocols, and are also inherently IP networks. Also, some simulators that are designed specifically for sensor networks are limited to a specific programming environment. We introduce Wish ; a wireless sensor network simulator designed to address these problems. Wish is built from the ground up to simulate sensor networks. Wish is efficient; it scales to simulate networks with thousands of nodes faster than real-time on a typical desktop computer. Wish is component based and easily reconfigurable to adapt to different: levels of simulation detail and accuracy; communication media; sensors and actuators; environmental conditions; protocols; and applications.

Keywords: Qualnet, Simulater, Sensor

256. Science in Advertisements

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Abstract. In our daily life, we come across advertisements where companies use science to bias the opinion of customers regarding their product. Companies pay misuse science and technology in different ways to reach their objectives. They can disguise advertisements in the shape of a scientific text, show properties that the products advertised do not have and emphasize what are the usual properties of products of the same kind. The advertisers take advantage of the poor scientific knowledge of the population for their benefit. In the present paper, we have analyzed several cases (i) advertisements of soaps and detergents, (ii) advertisements of toothpastes
(iii) products of technology
(iv) a depicted image of scientists.

257. Role of Hands-on activities in Science Communication

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Abstract. Science and Technology are the two basic components of developments of a country. Common people can learn about the advancement of science and technology with the help of mass media. A science communicator connects the common people and the scientists by acting like a bridge. The main function of science communication is to exchange information between an informer and a receiver.

To make science communication interesting and informative, it should be activity based hands-on demonstrations. In this paper the author presents his experiences of such type of communication as he is engaged in two projects simultaneously namely Teachers' Orientation Programmes as well as Interactive Science Workshops for the middle school students.

Keywords: Hands-on, Scientoons

Introduction

Science education now-a-days looks uninteresting and sometimes boring. Students are interested for more lucrative career options other than pure science. But no country can progress without the development of science. So we have to be more serious about the way of presentation of the concepts of scientific principle. One way of effective science communication is the hands-on demonstrations. It is difficult to surpass the learning impact of the combination of hearing, seeing and doing.

According to the renowned science communicator, Dr. Manoj Patairiya, digital media now-a-days plays tremendous possibilities for science and technology communication among various target groups (Patairiya, 2000). Although Professor Yash Pal, the famous National Professor, information technology and digital technology are not knowledge creators but knowledge workers (Patairiya, 2009).

Again Scientoons are a new type of methods of effective science communication by using cartoons based on scientific theories (Ray and Dutta,2009). Science outreach programme is one of the fruitful approaches for science communication (Jana, A.K. 2010).

Hands-on Demonstrations

Experiment No. 1: Action and reaction.

When a balloon is attached in the string with a straw, it will move in the opposite direction to that of the direction of the air flow from the balloon. But when a post card is attached on the same straw with the balloon, there is no movement of the balloon as the action and reaction acting on the same body.

Experiment No. 2: Simultaneous decrement of pressure with the increase of speed.

An inflated balloon is placed in each of the thermocole glasses, one having a few windows and the other with no window. A straw is introduced through a hole at the bottom of the glass. When air is blown through the straws, the speed of air inside the glass is increased creating low pressure. The air with higher pressure from outside press the balloon on the mouth of the glass without window. But in the case of windows the air rushes in the glass through the windows and makes the balloon fly. This is a nice demonstration of Bernoulli's principle.

Experiment No. 3: Effect of atmospheric pressure.

The experiment of the rise of water level in the inverted glass which covers a burning candle placed in water is a very common demo used by many teachers to show that 21% of the air is oxygen. But using unequal number of candles it can be shown that the rise of water has no relation with the oxygen content in air. More the number of candles more is the rise of water.

The reasons are:

(i) The pressure of hot air is high and some air escapes and hence the rise of water due to this loss.

(ii) At higher temperature the saturation vapor pressure of water is also high. When the candle goes off and

the temperature falls, saturation vapor pressure also decreases and hence the water rises.

Experiment No.4: Electromagnetic Induction.

When a magnet is falling through a vertical conducting tube with poles along the vertical, a changing magnetic field is produced. This field drives an electric current in the circumferential direction along the length of the tube. The magnet thus experiences an upward damping force and takes an extraordinarily long time to fall through the tube due to electromagnetic damping.

Conclusions

Being a resource person of a few projects of teachers' as well as students' orientation programs since 2005, my experiences confirm that students are observant and curious-they love to explore the world around them. Their scientific skills can be improved by teaching them the scientific concepts of the relevant scientific principle with activity based hands-on experiments (Jana, A.K. 2010). According to Kala (2009), 'Hands-on science activities have some advantages over other communicators, as the great compromise of literacy and knowledge label is only possible here.

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258. Public Engagement with Nanotechnology: Initiatives, Strategies and Challenges

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Abstract. Public engagement with science and technology (S&T) has assumed significance in recent years particularly in the context of emerging technologies. Public engagement implies that the public, as non-experts, are an integral part of all deliberations on policy, regulation and governance of S&T. Increasing scholarly attention in science and technology studies (STS) is given to public engagement in nanotechnology (NT), arising at the intersection between science and society in both developed and developing countries. This paper discusses the role and importance of public engagement in NT; attempts to map the various initiatives as well as strategies for NT governance and identifies various challenges to be addressed for its responsible development.

Keywords: Emerging Technologies, Nanotechnology, Public Engagement, STS

Introduction

Engagement in common parlance is used to mean involvement. Public engagement has become an umbrella term covering public consultation, public discourse and public involvement. Public engagement with S&T can be attributed to a tendency towards increased democratization of science. It can also be seen as a reaction to technology development policies that are seen as contributing factors to unacceptable technologies. Whatever the reason, stakeholders–government, business groups, scientists, citizen and interest groups–are currently arguing for the radically new technologies like nanotechnology (NT). NT is currently referred to as leading, innovative research field. Besides revolutionizing a range of scientific and technological areas, R&D in NT promises to have favorable environmental impacts, on the one hand and on the other, adverse health implications of particles at the nanoscale level are compared to those of asbestos (Poland et al., 2008). The most prominent are the messages that portray nanotechnology as "the asbestos of tomorrow" (Scheufele, 2006).

This paper intends to answer questions such as: What activities are contemplated under the label of public engagement? How public engagement is ensconced in science and technology studies (STS)? Why is it important? It then outlines the need for public engagement with NT and examines how dialogues, initiatives and resources in NT have been utilized in various countries to engage the public. To do this, a review of the existing literature and policy documents was undertaken. An attempt is made to map the various public engagement initiatives worldwide in terms of degree of spontaneity and intensity of engagement by adopting the theoretical framework originally developed by Bucchi and Neresini (2008). We also consider the perspectives from institutions and organizations collected during field-surveys on NT in India. Finally, the paper addresses various challenges for engaging the public with NT.

Science, technology and public engagement

What are public engagements? According to Nanotechnology Engagement Group (Gavelin, et. al., 2007: 9), public engagements are "all the different ways in which institutions interact with the general public outside of formal democratic structures such as elections". In this definition, institutions include members of what we call the NT establishments (government, scientists, technologists, academic researchers and policy-makers). Public engagement with science and technology (PEST) has become an important new dimension as well as a specialized area of investigation within STS. It springs from a report, The Public Understanding of Science, which was published by the Royal Society in 1985. This report provided how scientists learn to communicate to non-scientists later known as the ‘deficit model’ of science communication. Here the public is assumed as ignorant and needs to be educated by scientists with the aid of the state. It legitimates further public expenditure on science through popularization programmes and pays no heed to the public response. In fact, science could be problematic for society if the latter is ignored.

Today the debate has gone beyond the ‘deficit model’ in science communication studies. An attempt in the deficit model arose when government scientists in 1986 tried to protect consumers from sheep contaminated by the Chernobyl disaster. But a classic study in this regard by Wynne (1989) showed that scientists didn’t pay attention to other available knowledge when making claims in the Chernobyl case. Because scientists did not consult with farmers on how to best monitor grazing habits and take samples from the sheep, leading farmers to directly witness the messiness of scientists’ sampling methods. The scientists’ ignorance, lack of interest in local realities, and imposition of false assumption about the agency of local people ended up in a loss of trust among the farmers and the consecutive failure of scientific experiments and predictions.

Wynne’s study suggested a new perspective of engagement of the public with science and later known as the ‘public engagement’ model. In the deficit model, the public distrusts science because it is ignorant, but in ‘public engagement model’ the public distrusts science because it has good reason to. The latter model established the agency of the public and demanded scientists to be more reflexive in science. This model has been widely accepted now as participation by public in dialogues or engaging with science and expertise without agency is impossible. In case of a technology like NT there is a need to increase awareness, involve stakeholders like trade unions in dialogues about occupational health issues, address concerns of consumers about product safety, discuss with environmental groups about the environmental impact of nanoparticles and nano-products and instill confidence about the regulatory regime.

What makes new technologies like NT worthy of being engaged? According to Toumey (2006), NT and public engagement have come to the fore at the same time “is a historical coincidence, not a scientific result”. In the 1990s, it emerged into public knowledge that genetically modified organisms (GMOs) had been added to the human food chain without public consultation (Gavelin, et. al., 2007: 2). In 2003, the British government began the GM debate and reviewed the science and the costs-benefits of GMOs? It consulted widely with citizens about why they opposed GMOs. Unfortunately, towards the end of the 1990s, as consumer anger was reaching a peak, civil society had convened conferences, and these were organized long after large companies had invested heavily and brought products to market. The government initiative was seen as “too late” (Ibid: 4). It is reported that the government’s desire to appear ‘precautionary’ led to a reactionary ban of GMOs, and public consultations that favoured environmental lobbies.

The public biotechnology (BT) debate has been pervasive in shaping S&T discussion in the field of NT (Gaskell et. al. 2005). The two fields show intrinsic similarities, not on material level but regarding their scientific, commercial, and governmental framing, and the actors involved in science communication. Experts in science, social science, civil society organizations, and technology assessment (TA) offices who had worked in public relations in biotechnology often became involved in the field of NT (Barben et. al. 2008). Thus, public engagement in the field of NT was from its beginning shaped by three factors: (i) the idea that science communication should have “learned lessons” from earlier S&T related controversies such as agricultural biotechnology; (ii) the idea that science communication in the notion of Public Understanding of Science (PUS) was “ill-defined” and not the right way to create public acceptance’ (iii) the claim for a broader involvement of the public in decision-making of S&T issues, in the notion of open democratic governance.

Public Engagement in Nanotechnology

Why do we look at what kinds of engagement have been undertaken? One reason is to illustrate how the shift from downstream to upstream and from one-way to two-way engagement is still going on. Primarily, we give a sense of what it is that we are discussing when we talk about public engagements. To understand these engagements, we have used the adapted version of the framework, originally developed by Bucchi and Neresini (2008), to map public participation in NT. In Figure 1, the X-axis denotes the level of public engagement in knowledge construction process. It is characterized by two extremes in the continuum ranging from low to high level of engagement. The Y-axis denotes the continuum of extent of public participation elicited by a sponsor to the spontaneity. In this diagram, a wide variety of forms and cases of public engagement exercises in NT can be mapped.

The upper left quadrant comprises forms typically elicited by a sponsor and characterized by low-intensity participation of the non-experts in the knowledge production of NT e.g. the public opinion surveys, citizen's conferences and citizen consultation exercises.

Public Opinion Surveys: This method of engagement has been the Danish and Spanish Board of Technology's response to NT engagement so far. Their surveys or interviews meetings involve a questionnaire to ensure that all thirty participants have a chance to be heard, and the group interviews provides some context for why people believe the things that they do about a given technology. This allows organizers to ask the questions that they think are important. These events take three hours of a weeknight and participants are sent material beforehand to get them acquainted with the subject. Participants are selected based on getting a range of representation, and on a lack of prior knowledge of the technology in question. The topics that are typically considered are complex, new and have an ethical component to them. The results of these interviews are published in a report and made available to policy-makers. Danish NT survey showed an overview of what those citizens found to be important. It found that citizens are excited about the possibilities of NT having a feeling that Denmark should take an active role in the development of NT. However, the interviewees urged for the technology to be developed for socially beneficial ends, and actively opposed developing the technology just to improve consumer goods and enhance human biology. Similarly, public opinion surveys were conducted in Spain for a project 'Dialogue on Nanoscience and Nanotechnologies' and disproved the stereotypes that public has little interest in S&T issues.

Citizen Conference: The most common form of engagement exercise is the citizen conference. It is being used in France, England and Switzerland. For example, Nanomonde and Nanoviv in France helped in generating public awareness and identify potential problems and solutions related to the development of NT. Nanoviv, a series of "public debates" organized in Grenoble by Vivagora, an association led by a small group of former science journalists. The objectives of Nanoviv are the 'identification of the actors and stakes', and 'formulation of recommendations for policy-makers'. These events normally last between one evening and few days. Participants are recruited through advertisements in a regional paper, or at universities. After expert presentations, participants from groups and discuss their viewpoints and have questions answered, before a plenary session summarizes the conversations. These events center on a particular issue or scenario.

The lower left quadrant in the diagram is characterized by spontaneous mobilizations through protest group. Protest groups use non-institutional means of communication e.g. Topless Humans Organized for Natural Genetics (T.H.O.N.G.) has protested in front of an Eddie Bauer clothing store in Chicago over the issue of health problems that could result from using coatings of NT in textile industry for manufacturing clothing. However, such actions have a little impact on influencing the dynamics of research because they lack argumentation, mission statement and list of members.

The lower-right quadrant includes spontaneous participatory forms of knowledge production through non- government organizations (NGOs)/Not-for-Profit Organizations (NPOs) without a deliberate sponsor.

NGOs/NPOs: They promote their positions through research, consultancy and lobbying. In the NT debate, these groups include ETC, Greenpeace, the Loka Institute. For example, the Action Group on Erosion, Technology and Concentration (ETC) Group is the organization calling for a halt to NT research and distribution until the sociological and safety issues are more thoroughly addressed. Interestingly, though the group has been consistent in their call for a moratorium, this is not the group's primary concern. Their primary recommendation is "that

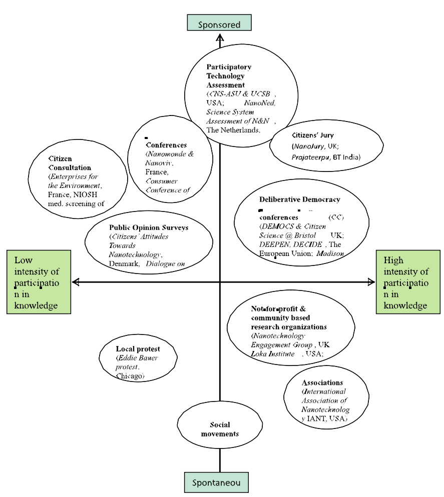

Figure 1. Framework for public engagement in Nano science and technology research Source: Adapted from Bucchi and Neresini, (2008)

society become fully engaged in a wide discussion of the role of converging (nanoscale) technologies" (ETC Group 2004: 53). This includes involving marginalized people, who the group holds in focus through their critique of this technology.

The upper-right quadrant is characterized by high degree of elicitation and high intensity of participation by a sponsoring institution such as consensus conferences, citizen jury, and deliberative forums.

Consensus Conference: It is being used in University Communities of Wisconsin and North Carolina, USA. This involves two preliminary, weekend-long meetings wherein a group, made up of fifteen to twenty lay-people from a variety of backgrounds, is introduced to the technology in question. They decide what issues are most important, debate those issues, and develop questions that they put to invited experts from the sciences and humanities, businesses and NGOs. A consensus conference topic should be "topical, not too abstract, contain conflict, call for clarification of objectives and attitudes, depend on expert contribution for clarification, necessary knowledge and expertise are available" (Grundahl, 1995: 2). Recent topics of consensus conferences in Denmark have included social topics (technological marginalization), environmental concerns (renewable construction), and topics that are of interest mainly to those in scientific fields (research grant size, information technology management).

The actual consensus conference occurs on a third weekend, and is open to the general public. Here the initial questions are answered, more questions are asked and the experts respond again. Finally, the citizen panel produces a consensus document based on the opinions of the participants. The involvement of the lay panel is stretched over three months. Consensus conferences support both quality and responsibility. By giving participants lots of time to consider evidence provided by several experts they can come to well-reasoned judgements, which will lead to better conclusions. They pass these conclusions on to those that attend the final conference and read their report. Furthermore, in Denmark these events sporadically garner wider public attention, leading to a lively public conversation, which reinforces both the feeling of responsibility that people have, and their ability to judge what options will lead to high quality.

Citizen Jury: The most intensive form of public engagement has, so far, been the citizen jury. NanoJury, a citizens' jury on nanotechnologies in UK organized by the Cambridge University Nanoscience Centre, Greenpeace UK, the Guardian, and the Policy, Ethics and Life Sciences Research Centre (PEALS) Newcastle University and used the method of "two-way citizens' jury." The UK Nanojury used a group of twenty-five randomly selected people and met every weekend for six weeks. To persuade people to give up so much of their time, they held another citizen jury before the nanotechnology jury based on a topic, youth crime that the participants chose themselves. The plan was for this group to have more control over what was brought up, being able to call the experts, or 'witnesses', that they felt were important. In general, jurors found the witnesses to be either pro or con, resulting in a more confrontational event than the one on youth crime. At the end of this process, the 'verdict' of recommendations was presented to regulators.

The few unanimous recommendations concerned continuing public engagements, labeling NT products clearly, and making funding transparent and tied to socially responsible projects. Consequently, the jurors wrote recommendations for nanotechnology's future development in the UK and received a promise from the Department for Business, Enterprise and Regulatory Reform of a response. The framing of the public as "citizens" and "jurors" and scientists as "witness" or "audience" reversed the traditional roles and thus supported the idea of mutual learning and two-way communication.

Deliberative Forums: It involves citizens, stakeholders, experts and decision-makers, for an in-depth understanding of socio-ethical challenges and implications posed by NT. For example, Deepening Ethical Engagement in Emerging Nanotechnologies (DEEPEN) of the European Union.

As part of the IDRC supported project on "Capabilities, governance and nanotechnology developments: a focus on India", The Energy and Resources Institute (TERI), a premier think-tank in India, carried out a field-survey for a period of two and a half month. The survey showed that scientists agreed for the communication and public engagement with NT as essential to avoid unexpected or unintended negative consequences. Since NT has been perceived as a much-hyped technology during the survey scientists remarked that "hype-generation is dependent on media due to the accessibility of various media to the scientists". A bio-medical scientist at a leading technological institute for research and education said that "awareness is good thing, hype is not, and paranoia is not. Rather there should be correct awareness". NT awareness can be done through campaign, public forums, exhibitions (e.g. where they showcase NT products, the potential applications of nano-medicine etc.), and seminars regarding its various features such as cost-effectiveness, user-friendliness, eco-friendliness and efficiency. Scientists agree that if there were greater public awareness of NT then there could be more support towards it. NT community should come forward and publicize more materials in this regard and finally the government should advertise ongoing NT research in that country.

Challenges and the way forward

The biggest challenge for public engagement in NT would be first of all to ascertain what do we collectively (aspire to) mean by public(s) and thereupon to ensure a wider representation of 'publics' during the process. Given the fact that the nature of technology is so complex with even scientific community finding it difficult to comprehend, there could be a possibility of engagement from only highly informed groups that are not truly representative and may not reflect the views of widely segregated and differentially capable 'publics'. Further who can speak for publics? NGOs and other "voices of civil society" have their own axes to grind? One significant dimension of the problematic of the PEST is how non-experts can understand, discuss and debate the latest developments in S&T such as NT and its most notable products. The question of the PEST is challenging because it is fundamentally about the participation of non-experts in S&T. In this regard, Melissa Leach and Ian Scoones proposed a set of 'citizens' commissions for S&T futures at the local, national and global scale in developing countries addressing particular sectors, technologies or policy issues, and generate input and perception of people about S&T, and the way in which it should be governed.

It is needed now to develop an appropriate public education programme about NT. It will bring the involvement of many publics. Many people will get virtually all of their understanding about NT from such programme. The entire NT community – scientists, engineers, policymakers, social scientists, lawyers, journalists, indeed the public at large – has much to gain from efforts to put into wide circulation better information about the nature of NT and what its realistic opportunities and risks are. More than anything else, institutions should promote and support avenues for discussion about the issues associated with NT. By doing so, would help overcome the cross disciplinary and cultural boundaries. Only with such new habits in place, one can fully tap NT's potential while avoiding its problems.

Concluding remarks

The theoretical framework emphasizes upon the fact that it is difficult to predict the outcomes of any public engagement exercise based on the structural features and sponsors' objectives. It would be important from the policy perspective to gain an understanding on conditions under which these diverse range of initiatives emerge. To conclude, a prudent approach to engage with NT could be to address the interface between NT and society from the perspective of social equity, social purpose, and structure of economic and social enterprises. Towards this, building up expertise in social science research in NT and increasing investment on the issue of public engagement in emerging technologies could help immensely. Finally, negotiations and deliberations between experts and lay people would provide new directions for research.

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259. Reducing Digital Divide using Data Mining Techniques for Better E-Governance

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Abstract. The term digital divide refers to the gap between people with effective access to digital and information technology and those with very limited access. In other words it is closely related to the knowledge divide or knowledge share due to the lack of technology and knowledge. The extraction of useful and non-trivial information from the huge amount of data available in many and diverse fields of science, business and engineering is called as Data Mining. Data Mining techniques and algorithms are the actual tools that analysts have at their disposal to find unknown patterns and correlation in the data. For effective use of E-governance in Tamil Nadu, the digital divide to be reduced. Most of the Government departments are already using E-governance in Tamil Nadu. This is the appropriate time for us to analyze the effectiveness and reach ability of technology to all sectors of peoples. Even the most learned peoples are reluctant in using the technology. This digital divide gap leads to improper usage of Information and Communication technologies. The objective of this paper is to analyze the following two important digital divide issues using data mining and present recommendations for better E-Governance in Tamil Nadu.

Improving Quality of Bandwidth / Parameters: Since, the information and communication technologies are being implemented in the Government at different levels; good bandwidth is needed for constant transformation of knowledge in a proper format. For the better usage of E- Governance, the quality and performance of bandwidth performance has to be increased. In Tamil Nadu, there are so many service providers available for connectivity. But, the expected quality of bandwidth is less than the assured bandwidth. This paper analyses the bandwidth parameters using data mining techniques and suggest a better framework for improving bandwidth across Tamil Nadu.

Taking Technology to reduce the gap: Now-a-days, many new information and communication technologies are introduced. The urban sector is reluctant in using the technology due to the fear of using the technology and also thinking communication/network failure, which occurs frequently. The middle age person still thinks that the technology is very far from them and also is very costlier. The rural sector is unaware of these technologies and they need to be provided infrastructure and training. With the increase usage of mobile phones; convergence of technologies also need to be thought of. This paper analyses the need of urban and rural sector people for the effective reach of technology. Data Mining Techniques are used for data analysis, which leads creation of to better E-governance standards.

The above mentioned parameters are studied by applying data mining techniques such as Association rule mining (determine implication rules for a subset of record attributes, Classification (assign each record of a database to one of a predefined set of classes analysis and Clustering Techniques (find groups of records that are close according to some user defined metrics) and a suitable framework is proposed for better E-Governance.

Keyword: Data Mining, Digital Gap, QoS, Bandwidth.

Introduction

When the IT industry increased globally in the 19th century, simultaneously the Internet and the Mobile technologies are also emerged into the world and ruled majority of the people. With this, E-Governance also booms out with the help of some Government Departments around the world. In India, National Informatics Center (NIC) played a vital role for the development of E-Governance in which they incorporate some of the Government related activated like Tax payment, Census Generation, Election Management, Disaster Management,[1] etc., In Tamil Nadu, some of the successful E-Governance projects are land registration, call for tender, issue of birth/death certificates, agriculture, e-transaction, RTO, tourism, infrastructure, land/local tax, local body election details, e-ticket etc., [1]. The major scenario in the above-mentioned successful E-Governance is heterogeneous based System. The entire activities of each Government related activities posses a unique database to store their respective data. This technique is followed in our state and also other states too [2]. As a fact, each Government department maintains their own database as unique and there is no interlinking between various departments/databases. When, the land registration department needs some information about agriculture data, they are not able to access the agriculture database. This leads to minimum usage of the e-governance projects by the citizens. The digital gap increases due to the issue and the important e-governance projects fails after implementation. This paper proposes the use of data mining techniques and a better framework to reduce the digital gap and to interlink the heterogeneous databases. This paper proposed two stages to reduce the digital gap:

a. Improving Quality of Bandwidth / Parameters.

b. Taking Technology to reduce the gap

Using Data Mining Techniques to Reduce the Digital Gap

Data Mining is the technique to explore and analyze the large data sets, in order to discover meaningful patterns and rules [6]. The evaluation of data mining techniques began when the business data are stored in the database and the technologies were generated to allow the user to navigate the data in the real time.

Recently, the ICT made a proposal for all the state and central Government for the betterment of database maintenance in the near future generation [3]. As we know, now a days, all the Government departments utilizes huge amount of data in their day-to-day work, which leads to maximize the access of current or history of datasets from the database [2]. But, it is not possible to fetch the datasets when they need. This is because of insufficient data, improper format, duplicated data, and some technical problems etc.,; When we discuss on other side, it is also due to less bandwidth, natural disaster, network failure, and loss of data during data transmission and collision of packet with one another etc. As a result of this, the end user cannot able to perform the operation with in the time and also little afraid to continue the E-governance system. Since, a gap is generated between user and existing E-Governance systems. As a result, the Government should concentrate on above set problems for the betterment of E-Governance. By considering these issues, this paper proposes the use of data mining techniques to reduce the digital gap. The major data mining techniques considered in this paper are [6] ;

a. Association Techniques. b. Classification techniques. c. Clustering Techniques.

Association: It is method for discovering interesting relations between the variables in the large database. There are different types of algorithm for association rule. They are Apriori algorithm, éclat algorithm, FP-growth algorithm, One-attribute-rule algorithm, Opus search algorithms, and Zero-attribute-rule algorithm [6]. Let us consider the existing E-Governance agriculture database as an example. Suppose, when a user needs a land for the cultivation process with the following features, i.e, good water, larger area, good manpower, and good soil. Based on the above features, the end user can easily search the availability of lands form the existing database with the help of some association algorithm. The one of the best algorithm for technique is Apriori Algorithm.

Classification: It is one of the data mining techniques used to predict the group for data instance. Some of the popular classification techniques are decision trees and neural networks [6]. From the existing database, the end user can classify the land with required parameters like state wise, of district wise, area wise and etc by means of tree like structure. By this classification technique, the user can easily classify the required data from the existing database using some protocols. Based on this, the user can identify the locations and nature of the land with a faster manner. Some of the best and easiest algorithms are decision tree and nearest neighbor algorithm that is available in data mining techniques for better classification.

Clustering: It defined as collection of data object that are similar to one another within the same cluster and dissimilar to the objects in the other cluster. Clustering algorithms are broadly classified into hierarchical and partitioning clustering algorithm (Jain and Dubes, 1988). Again, the Hierarchical algorithm are Agglomerative and Divisive algorithm and the Partitioning Algorithms are k-means, k-mediod, DBSCAN, CLARA, CLARANS, BIRCH CLIQUE, OPTICS etc [6]., When a person is willing to find the group of land for cultivation respective of location, the user can apply the clustering techniques with the existing e-governance database to form a new groups based upon the user requirement. Thus the user may satisfy. This is the appropriate time for us to discuss the effectiveness and reachability of technology to all sectors of people. Even the most learned people are reluctant in using the E-Governance technology. This digital divide gap leads to improper usage of Information and Communication technologies. By using the above specified data mining techniques, the digital gap is reduced which in turn help the state to move towards implementing better and quality of E-Governance projects.

Improving quality of Bandwidth / Parameters for Better E-Governance

In general, some of the service providers like BSNL, AIRTEL, etc., are available for network connectivity in Tamil Nadu for good quality of Bandwidth. Bandwidth is defined as amount of data transferred in a given period of time [8]. Since, each service providers are having different qualities of bandwidth. But the expected quality of bandwidth is less than the assured bandwidth. As result the network connectivity in Tamil Nadu reached towards down state. Due to this, the successful E-Governance projects get failed while performing data transactions. By considering the above facts, the quality of service (QoS) need to be improved and also all the service provides are expected to provide guarantees for constant network connections. Bandwidth is one of the major constrain for better E-Governance. Some of the parameters are identified to rectify the poor bandwidth problem. For constant connectivity and the better usage of e-governance, the identified parameters are as follows [8]

a. Availability
b. Throughput
c. Data latency
d. Error rate
e. Network Traffic
f. Routing Performance.

Availability: It is defined as the probability that a device will perform a required function without failure under defined conditions for a defined period of time. In most of the case, availability is an important characteristic of system but it becomes more critical and complex issues on networks. With the help of Data Mining technique the network availability are classified with various parameters and helps the service provided for better network availability. Thus, by applying the classification techniques in network database, availability problem will be rectified.

Throughput: It is defined as the rate of communication links or network access. The Throughput is generally measured in bits per second, and sometimes in data packets per second or data packet per time slot. By applying the data mining association algorithm, the service provided will come to normalize the size of the packet for data transformation from one place to another with respect to time and network availability. Based on the mining techniques, the problems are identified and help in future that is not repeated.

Data latency: It is defined as how much time it takes for a packet of data to transfer form one destination point to another destination. The latency mainly depends on the nature of the electromagnetic signal. Thus the latency may be differing from device to device. Hence, data mining association techniques are applied on the history dataset to identify when the problem happens and how the problem happens; Is it happen previously? If yes, what actions are taken to solve the problem?

Error Rate: It is defined as the number of received bits that have been altered due to noise and interference while during digital data transmission. The error rate may vary from device to device and software application to application. Thus by applying clustering techniques, the service provider can mine the error rate with respect to the hardware and application software from the previous data. Based on this method, the service provider knows which application software Vs hardware device suppose to minimize the error rate.

Network Traffic: It is defined as the data in a network, where the network traffic controller controls the traffic, bandwidth, prioritizing the data packet while during transformation form one point to another. The major part is to measure the network traffic like where the network congestion happens, with this, the classification techniques are applied and the same issue was happen in the previous days or not. Based on the result, the identified problems are rectified.

Routing Performance: It is defined as measuring the performance of the router depends upon the load offered of it, i.e. by means of heavy load of test traffic will reveal the performance. Based on the traffic and load the performance may vary. For better performance, the traffic should be shaped and the packet size should be constant throughout the entire process. With the help of data mining classification techniques, the provider can mine the lesser traffic network for better routing performance.

Network problem happens not only due to technical side but also due to natural calamities, breaking of cable, etc. From the above scenario, the Central or State Government has to rework on the above-mentioned areas to improve the bandwidth performance by means of advanced networking technology, Fiber Optic and recent computing technologies will acted as catalyst for improving bandwidths.

In this paper, bandwidth parameters are analyzed with the help of few data mining techniques for network connectivity to improve the bandwidth. The framework is developed to provide better network connectivity for E-Governance. This paper analyses the bandwidth parameters using data mining techniques and suggest a better framework for improving bandwidth across Tamil Nadu.

Proposed Frame Work for Reducing the Digital

In Tamil Nadu, there are more successful E-Governance projects being implemented. But, all the implemented applications are heterogeneous in nature i.e. the databases are not linked for effective usage. Due to the non-linking of databases and availability in different geographical locations, there exist a digital gap. In the proposed framework, a new concept is introduced to reduce this digital gap, instead of storing the data in different location. This paper proposes the creation of data warehouse, which is a subject-oriented, integrated, time-varying, non-volatile collection of data [5][7].

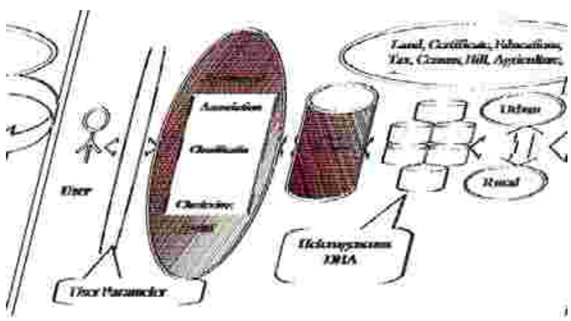

Figure1. Frame work for betterment of E-Governance in India

All the existing and emerging E-Governance databases which is heterogeneous in nature and available in geographical locations are combined and get stored in a common place called 'Data Warehouse'. It may be called as state data warehouse or data repository. The users using a particular E-governance application is able to use the other application also effectively thereby the usage of E-governance applications are increased. Thus, digital gap is also reduced.

From the above figure1, the E-Governance technology/applications data are collected from different locations and get stored in different database. This paper proposed a framework in which all the heterogeneous databases are combined and stored in one common place called data warehouse [5]. It contains the summary of all the data, which are made available in a day today process. As per this concept, anyone can access any kinds of data at any time by the data warehouse with a faster way. Different data mining techniques are also made available in the proposed framework. By applying these data mining techniques based on the user requirement, the user can mine the data with meaningful order, proper format and in time [7]. Hence, the Tamil Nadu Government E-Governance projects are used more effectively than other State Government projects. With this work, the technology gap is also reduced and the users may utilize the E-Governance by higher level.

Conclusion

In this paper, the importance of digital gaps and the parameters for reducing the digital gap with the E-Governance in Tamilnadu are discussed using different data mining techniques for the better performance. Various network Quality of Services (QOS) parameters such as availability; throughput, data latency, error rate, network traffic and routing performance are considered in data mining perspective to increase the available bandwidth. With the help of proposed framework, the gap also gets reduced between the user and the E-Governance systems which enable the Tamilnadu government to implement successful projects.

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260. Looking at Communicating Science for Ecosystem-Based Management

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Abstract. This seminar will look at science communications as a mechanism for integrating science into an ecosystem-based management research partnership. Using new and applied methods the Hawai‘i Institute of Marine Biology (HIMB) Northwestern Hawaiian Islands Research Partnership will be used as a case study looking at the intricacies associated with science management integration. This application to a specific partnership has both global and local significance dealing with large-scale marine ecosystems. Partnership participant’s attitudes and perceptions towards science communication and interdisciplinary integration will also be explored. Evaluation and application of lessons learned will be used linking theory and practice. A review of the current science management literature will also be included exploring how the research partnership and new large-scale ecosystem based management fits within science communications. The Papahānaumokuākea Marine National Monument (Northwestern Hawaiian Islands) is an excellent example of science management integration, with various stakeholders and the recent designated as an UNESCO World Heritage Site. Managing this area using an ecosystem-based approach takes a team comprised of natural and social scientists, managers, educators and policy specialists. HIMB is distinctive in that its faculty has been conducting ecosystem based research in the Monument for over five years. Unique and biologically important science is used to promote an understanding of complex ecological systems and topics such as biodiversity and climate change to management and communities within the Hawaiian Islands. Successfully amalgamating marine science concepts using interdisciplinary approaches, this program has worked to develop a sense of place in the community, strengthening relationships between schools, neighborhoods, and society.

261. Study of the Communication Methodology for Aadhaar and Issues in it’s Acceptance and Adoption by the Common Man in India

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Abstract. Information science, an imperative aspect in any innovation enables people at the ’Bottom of the Pyramid’ into entrepreneurs. In recent time new modes of communication are being governed by varied government, and non-government institutions. In the niche of innovations ‘Aadhaar’ has attained paramount importance in terms of aquaintance and usage of communication technologies to simplify pulls and pushes confronted by common man of a highly populated developing country like India. The Objective of this paper is (a) To understand how the communication for UIDAI (Aadhaar) is being planned and undertaken .(b) To study what can be the issues in it’s acceptance and adoption. ‘Aadhaar’–UIDAI is an example of a methodology to bring revolution in not only how people access technology, but also in how the country is governed, starting with the domain of national and social security. It is being developed to be a multipurpose National Identity card. This unique identity card, it is believed would help address the issues related to subsidies and prevent embezzlement of funds for poverty alleviation programmes such as NREGA, other than the issues related to national security. It uses the technology of asymmetric key cryptography and symmetric key cryptography. India being a unique country with it’s diversity in culture and traditions, a methodology of the kind of ‘Aadhaar’ would require distinctive and customized solutions for communication and adoption. We would be considering some cases in perspective and how the ‘Adhaar team’ are coming up with tieups and methods to cater to such issues. The name ‘Adhaar’ as well as the logo signify ‘foundation and hope’ and can be well associated with by the people of India. We would also be considering similar examples from other countries and the challenges faced by them during the initial years of adoption and how they solved such issues. In addition, we would also refer solutions based on expert opinion and our own perspectives. Secondary data and expert opinions would be considered for writing the paper. Implications and value: The paper envisages to understand and present a general perspective on mass communication, adoption and acceptance of ‘Aadhaar’ which has social, political and economic relevance.

Keywords: Information science, Entrepreneur

262. Public Relations as an Important Tool of Science Communication with Society: The Case of Poland

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Abstract. In the field of science, Central and East European countries (CEECs) have inherited various relics from the past, among them:

- bad communication between science and society,
- low level of public understanding of science (PUS),
- weak co-operation between the science sphere and the production sphere,
- small scale of commercialisation of science,
- practically non-existent infrastructure of scientific and technological knowledge flows in society.

At present, the market reforms in CEECs are far advanced. So now, the main direction in their developments is to build knowledge-based economies/societies. In reforming Central and East European countries towards modern market economies, the science sector faces numerous challenges. Among them, there is the challenge: How to communicate better with society? There are various tools of such communication. One of them is Public Relations (PR). The main aim of this paper is to prove the big potential role of Public Relations as a communication tool between science and society, with a special reference to CEECs. Poland will here be a case-study.

The following issues will be analyzed in the paper:

1. The role of science communication: A brief survey of the literature
2. Public Relations as an element of marketing communication
3. Polish experiences: A short evaluation
4. The desired role of Public Relations in science communication
5. Conclusion

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263. Understanding Snake-bites and Soil Salinity–Science Communication over "New Media"

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Abstract. The Understanding of and application of scientific principles holds the key to technological progress and developmental goals of any nation. Rural India is characterized by poverty, illiteracy, infrastructural inadequacies and the myriads of ills that plague those below the poverty line in the third world stemming largely from the lack of scientific awareness, and spread of community knowledge.

Over the past decade information and communication technology (ICTs), specially new media like the Internet has brought information access far closer to the rural populace. Information Kiosks have been set and cellphone coverage has scaled rapidly.

These new forms of media provide unforeseen opportunity in spreading scientific awareness that can help overcome superstition, improve health care and even provide access to income. However technology options are not sufficient by themselves. Public communication for dissemination of scientific knowledge needs to be participative in nature and focus on the needs and benefits of the community itself. Implementation of such projects needs to take a holistic view that encompasses a multi-disciplinary approach towards the problem.

This paper presents some experiences as well an approach and a plan for a large scale intervention of scientific knowledge with community participation that can be successfully implemented utilising the existing investments in basic infrastructure. This is largely drawn on our previous experience in working with the rural community and building a successful effort of capacity-building and livelihood generation for the rural community in Sunderbans.

Keywords: Capacity-building, Community, ICT4D, Information technology, New media, Poverty, Rural knowledge centers, Science communication, Village information networks

Introduction

The past few decades have been marked as much by technological progress as its inability to address or even impact the issue of poverty eradication. In most developing economies, the Human Development index (HDI) is fairly low even in the face of rapid economic growth. In India–a country that can take pride in its technological advances and its growing economy–the HDI ranking is at 128 for 2010 and 134 for 2009, among 182 nations.[1] The Multi Dimensional Poverty Index (MPI) developed jointly by UNDP and Oxford recently show many states in India with poverty levels lower than many areas of sub-Saharan Africa.[2]

The demographics of the citizens of India based on the census of 2001 shows that 72.18% reside in the villages while 27.82% live in Urban areas and only 13.20% of these are in cities of population 500,000 or above.[3] This large percentage of citizens survive on an income below the poverty line of $1 a day and have a very low literacy level, and their exposure to Information and Communication Technology (ICTs) are almost nil.

The disparities in income are wide between the educated urban elite and the impoverished rural people for whom even earning the bare minimum is daily challenge. Lack of basic scientific knowledge on health and hygiene makes much of the population prone to disease and vulnerable to exploitation. This trend is not isolated but manifests itself in other developing economies as well.

New Media–Opportunities

So what impact can technology really have in overcoming the problems we face in public dissemination of scientific knowledge?–the topic of this particular conference and the deliberations of the past few days.

From the 1980s India has extensively used the national television channel for broadcasting scientific information to the people. Through a programme under the University Grants Commission, educational and scientific programmes are prepared at universities by students of mass communication and televised. But television content, which does not allow interactivity, still remains as a traditional form of media.

What is new media?

The question is what exactly do we mean by "New Media"? It is a common perception that any form of electronic content, broadcast TV, radio, electronic music played on computers or static pages on the Internet classifies as under this category. But digitisation alone does not define new media.

New Media technologies are better defined as those which allow the user full interactivity, in deciding the access to the content, and perhaps even the form of information, like text, language, video or audio. New Media thus allows "on-demand" access to content keeping the users in control of what choices they make. This option for interactivity is enabled by the technology of to-day whether it be the Internet through computer terminals or access to TV channels over a mobile device or even an IVRS information retrieval system.

We all know how advent of Internet and communication technology has changed the world we live in to-day. Instant delivery of information that you need from anywhere in the world is possible in a matter of minutes, even seconds. Scientific and technological research can now be shared seamlessly across geographical boundaries. It is said that Internet is not just a new Media – it is a new way of life!

Bridging the "digital divide"

But till recently all of this was the prerogative of only the rich educated elite in India and this led to the coinage of the term "Digital Divide".

The Indian Government was guided by the Millenium Development Goals set up by the United Nations to create a world free of poverty by 2015, which declared a commitment to "make available the benefits of new technologies especially information and communication technologies (ICTs)"[4]. Subsequently a number of initiatives have been taken by the government of India to extend the reach of these technologies into rural populace and cross this so-called divide.

Mission 2007 was initiated to provide access to information to the 600,000 villages in rural India. About 100,000 "Information Kiosks" called Common Service centers (CSCs) have been set up in 1 in 6 of these villages in a Public-Private-Partnership model. These have been linked to the State Wide Area Network and are operated by Village Level entrepreneurs.[5,6] While primarily meant for delivery of government services there is an unlimited opportunity to access this ready infrastructure for the purpose of interchange of scientific and technological knowledge with the rural communities.

The Indian government simultaneously focused on increasing rural connectivity both through Cellular bandwidth expansions. Cell users in urban areas are taxed by the federal government to help build a corpus fund called "Universal Services Obligation Fund" [7,8] which is then invested in infrastructure for cellular coverage in rural areas. In recent years the growth of cellphone usage in rural areas, with the simplicity of voice communication that can be used even by those challenged by technology or education, has overtaken the revenues generated in urban areas!

This infrastructural backbone can then provide a robust and effective platform to meet the objectives laid out under Public Communication of Science and Technology – namely "the ability to respond to technical issues and problems that pervade our daily lives and an appreciation of the way science works and how the community can interact with science to help shape its work".

From the technology perspective it appears to be an ideal scenario and it is tempting to suggest an all pervasive solution where scientific information is provided as content; and we wait and expect that the community will benefit. This is no more than the using new media in the same broadcast mode of the earlier technology like radio or television. While dealing with rural community it is extremely important to understand the impact of these tools and to effectively utilize them; and to illustrate this we share some of our experiences from our previous experiences in working in the areas of Sunderbans, part of the Gangetic delta in West Bengal.

The Rural Perspective–(Sunderbans)

"Sunderbans" part of the Gangetic delta basin –the world's largest delta, is also one of the poorest sections of the world. Sunderbans is a World Heritage site of UNESCO, which straddles the countries of India and Bangladesh. The Indian part is home to about 5.4 million people a very high population density for a rural area.

The Sunderbans have no cities, just scattered villages and islands where there are settlements and protected forests.

Travel between the islands is mainly by boat. The community traditionally has agricultural and fishing livelihoods. But the produce–fish, timber, agricultural produce, honey is shipped to the urban areas for further processing. There are no industries and the per capita income of the inhabitants is largely unknown; the reported figures show 37% living below the poverty line quoted at the figure of $1/day, but in reality the percentage is far higher.

Figure 1. Travelling in the Sunderbans

The area is disaster-prone and often ravaged by cyclones. The largely fishermen community also remain at risk, due to lack of effective disaster warning systems.

The youth of the region often do not complete their formal education as they cannot attend schools regularly due to long sailing trips on fishing trawlers where they work as hired labor as sole bread-winners in their family. Those who do have the means to get an education – there are schools and even many government run "colleges"–are excluded of the livelihood opportunities due to lack of skills and capacity for the workplace. The rural youth migrate to the urban areas but with no exposure to computers, considered a basic tool at the workplace of to-day, they would find themselves excluded.

Our organization, in partnership with another philanthropic agency, Anudip Foundation ran the ICT-based Skills training project for rural youth, in this region, leading to livelihood options. Many of the youth trained by us have been operating the Information Kiosks under the CSC scheme in this region. [10]

Figure 2. Rural Internet Centre

Community Needs and Relevance of Scientific Knowledge

In June 2009, the cyclone Aila hit West Bengal and many areas of this region in the Sunderbans was affected by flooding and isolated from the mainland. Relief efforts included food and medicine supply but for many of the people who were homeless, without any shelter the problems of health care were critical. For many of these people the critical need for "scientific knowledge" at this juncture were precautions on how to avoid infection and what measures to take. Sometimes even age-old remedies were shared across villages, especially where infrastructure made it hard to reach medicines. Simple precautions like boiling water, or even regularly washing hands and lessons in hygiene had to be shared across the community.

Post cyclone one of the major hazards that emerged was the proliferation of snakes due to the flooding of ground and old buildings. A local Community Based Organisation (CBO), Aikatan, developed a set of posters that could be used by the villagers to quickly identify the poisonous variety of snakes. It is well known that in case of snake bites, many deaths are more due to shock and fear. Confidence to identify the poisonous variety of snakes and basic first-aid techniques go a long way in being prepared and are welcomed by community. Groups of youth toured many villages in the area with these posters.

During the cyclone another problem that arose was the breaching of many of the embankments near the villages. This meant that the saline water creeped into the agricultural lands and made cultivation impossible. For the rural poor whose only livelihood option was the farming produce–there was little choice left to them but for migration to the city in search of work they were ill-qualified for.

What scientific options could have been made available for quick desalination of the soil? What crops could be grown in this saline soil? These were the scientific questions that needed answers–the relevance of the problem and quick solutions needed would make the interactive approach of the new media the most suited for cases like these–and perhaps this would lead to the means for poverty eradication.

Holistic Approach

These experiences shared by the community during and after the cyclone Aila clearly brought to focus the need for the relevant scientific knowledge, as applicable to the situation. Information needs of the rural Community are quite different from the urban populace, and many of us as "outsiders" do not perceive this while disseminating scientific knowledge. The need for the community members to identify the requirements for knowledge areas must be clearly the focus.

Development practitioners have widely accepted that community interventions need to be participative in nature as no external effort can be sustainable. Tools like PRA have now become the standards for any development initiative to ensure that there is a complete community buy-in, and the community itself is a stakeholder, otherwise any development goal is unlikely to be met.[9]

For the dissemination of scientific knowledge a similar approach needs to be followed. Community members as stakeholders need to identify the critical areas of knowledge. Perhaps the same Participatory tools which are used in the social sciences can be used here, with a few community members being assigned pivotal roles. Thus to effectively disseminate knowledge we need to take a multi-disciplinary holistic approach encompassing social science, technology and the basics of scientific principles. Not only that the exchange must be a two-way process. Traditional knowledge sometimes residing in the rural communities must also be captured and shared and it is exactly this type of processes that can be effectively supported by the new media technologies that are available to-day.

An Implementation

The network of Rural Information Kiosks available today provides the best opportunity to implement this knowledge sharing. The village level entrepreneurs who operate these kiosks enjoy the confidence of the community and are well aware of the problems that they face. In fact much of the problems illustrated by us have been shared through their experiences.

What is really needed is the option to be able to upload and share problems that need technological or scientific solutions. These need to be addressed quickly and effectively and answers need to be given by people who have both the scientific know-how as well as experience of working in the community so that the solution has relevance.

Our proposal is to build a rural knowledge portal in local language that can help add to the knowledge base. The technical solution would have the following:

1. A web Portal where the community can upload their questions and problems.
2. A facility where they can also upload and share solutions, or knowledge (as in the case of the snake-bite awareness programme).
3. An Interactive Voice Response system that allows for community members to call-in and check for simple problems
4. A Help-line where community members can actually speak to a person who would provide answers (this may even be the Information Kiosk operator who can tap the local knowledge base).

With this simple set of technology infrastructure it may be possible for us to extend the reach of scientific knowledge to millions and provide them with an option for improving their livelihoods. It appears such a simplistic solution, we wonder why this has not been done, and if it has, why it has not worked in the spread of scientific knowledge?

The reason is that technology alone can not be considered as a solution – it is the community that needs to take the ownership and there are several barriers that need to be overcome for this to be an effective method to meet our goals. Technology cannot be the driver for communication, it needs to be the slave.

Key success factors

So what are the key success factors that can help us use this technology to meet the goals of objectives that PCST 2010 has laid out? The PPPO model which takes into account not just the technological backbone but the people, process, participation and ownership is perhaps the most effective means to achieve this.

People: The most critical aspect of using any technology is the need to understand it and control it. Empowerment comes when people feel that they are in control of the systems that they are using. Fear of technology inherent in people and more so in the traditionally rural background this continues to remain a barrier. It is therefore necessary to overcome this critical area first.

Technology challenges can be conquered only when people learn to use it. The ideal solution for this is simple usage methods, and graphical user interfaces, perhaps even technology like touch screen that can be easily learnt by the rural community in the villages.

The key to the successful implementation of this project then lies in capacity building for the community or even the kiosk operators/village level entrepreneurs who by nature are trusted as they belong to the community itself.

Process: The next barrier is in the process of disseminating or even collecting scientific knowledge. The scientific body of knowledge needs to be formulated and this is an area where the easy uploading of content in the form of sharing experiences, can be extremely effective. Traditional knowledge sharing needs to be encouraged. It is better than the earlier "broadcast" modes of only the experts being expected to upload the knowledge.

For community members, perhaps a remunerative model where those who upload content can be paid nominal amounts may work as an incentive to gather the real knowledge base residing in our rural communities. This would also add a livelihood and income option to the poor communities and encourage use of the large number information kiosks and internet centers that have been already set up.

Participation: Equally critical is the relevance and access of the scientific principles itself. If answers to questions are available at the time of need, that is when the public communication of scientific knowledge will be useful. Rural communities do not have the time or luxury to use technology as an entertainment tool, for them it must be a utility, accessible when needed for helping them in their struggle for daily living.

Ownership: And finally the community needs to feel the ownership of the knowledge base and the technology available through their local access means. The oft-quoted words of Abraham Lincoln's Gettysburg address for government "of the people, for the people, by the people" [11] needs to extend to scientific knowledge for the grassroots community and only then can we achieve our desired goals.

Conclusion

While this paper outlines the use of new Media in public Communication of Science and technology, our role has primarily been in capacity building among the rural communities. We are also part of the Rural Knowledge Network (Grameen Gyan Abhijan) in India which strives to promote this free flow of information between diverse rural communities in India.

Our future plans include more stress on developing content in this area of scientific knowledge, both from expert knowledge sources as well as from the rural community. We also hope to extend our model to use not just Internet and computer based access, but also cellular and voice communications which can even overcome the barriers of language and literacy.

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264. Multipronged Approach for Popularization of Science and Technology among the public

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Abstract. The rate at which Science and Technology is advancing in the world is simply unimaginable. It needs superhuman efforts to communicate Science and Technology to the public. However a large number of steps are already being taken by Govt. and Non-Govt. organisations in this regard. Yet it is inadequate. One solution appears to be to make it a mass movement. For this a multipronged approach may be made to expose and train the heads/leaders of various groups who can take Science and Technology down to the individuals at grass-root level.

Keywords: Mass movement, MP, MLA, Multipronged approach, NCSC, Panchayat raj, People's representatives, Science centres, Student

Introduction

A glimpse at the steps taken in the past for popularisation of science by Govt. and Non-Govt agencies would indicate that, perhaps no stone has been unturned in this regard. Some are useful, some very useful and some are excellent.

Pamphlets, Leaflets, Articles in Print Media; Books, Magazines, Radio, Television, Talks, Debates, Jathas, Slogans, Morchas, Posters, Flagmarch with placards, Exhibitions, Museums, Quiz Competitions, science based Cultural programs and Folk art etc; are only indicative and not exhaustive. Prizes are also awarded as incentives for all these.

Yet, it appears, there is much more that can be done.

Can this be converted to a mass movement - a movement to which people from all walks of life can be roped in? They can be made to be actually involved and contribute significantly in their own way.

Multipronged approach

Yes! It is possible. For this we can have a multipronged approach. We have to identify the groups, create awareness among their leaders/heads and train them. An approach can be to identify them by their age group, level of education, their pursuits of daily life, vocation, profession etc. For example, we have students, teachers, doctors, politicians, peoples' representatives, administrators, assistants, scientists, business people, corporate houses, social workers/self help groups, women groups, tribal groups, industrialists, labourers in organised and unorganised sectors; armed forces of all wings and paramilitary forces etc.

These different groups have different levels of education, understanding, exposure and interest. Hence, while taking science to them, we have to adopt different approaches, strategies, methodology, techniques and mediums.

One can design and distribute leaflets, booklets, documents for different groups, organise meetings, training programs, workshops and interactive sessions. The duration of the programmes can be varied, from a few hours to a few days and spread in different locations. For top echelons, we may choose Secretariat Conference Room, Administrative Academies; for MLA's, Assembly or suitable Halls; for MPs, Conference Halls; for Collectors/Block Level Officers, collectorate conference halls and so on. For the grass root level, there are respective Panchayati Raj office premises. These meetings or workshops can be replicated for similar groups at other locations.

The leaders in turn can take suitable steps for bringing science to the groups they head, formulate programs within their scope for inculcating scientific temper, removal of superstition and blind beliefs as well as appreciation of scientific activities & achievements at different levels.

Experience

The approach indicated above is based on some experience we had in Orissa, way back almost three decades hence, in the Department of Science, Technology and Environment when a massive program was launched for creating awareness on Environment - various issues involved, steps to be taken at different levels, the roles to be played by the various groups and individuals, policies to be advocated for adoption by Govt. etc. A number of incentives and awards were instituted. These have since become a part of the system and have done yeoman service for creating an impact on protection of the Environment in the State.

Another program recently organised by the P S Planetarium, under the aegis of DST, GOO is 'Scientific Exposure Visit' for students selected from 254 schools under Tribal Sub Plan of the state. Students were brought to Bhubaneswar, accompanied by some teachers and camped for four days. During this period, talks by eminent scientists and visits to scientific institutes, like Institute of Physics, IMS, PSP, RSC, RMNH etc; were organised. Participants made notes on their observations and had interactive sessions at the end of the day. Selected students were awarded prizes at the Valedictory function. This has been done for 2 years in succession. The participants had a rich experience which was communicated to their school mates.

Let us analyse some of the groups:

Students

Students constitute a major part of the society. As the future generation of the country, this group deserves maximum attention. Rightly so, a large number of programmes are being implemented. Besides science as a part of the curriculum, the other programmes implemented are Science Exhibition, talks or lectures, various competitions, National Children's Science Congress – starting from individual schools, through Zonal level to National Level, participation with a focussed theme; visits to Science Centres under NCSM, though a very few in number; observation of various National Days like NSD, World Environment Day, Technology Day, visit to Science Express, though only a small section is benefitted; special programmes on TSE, Olympiads and so on.

Yet a few more things can also be done. More science based programmes can be broadcast by Radio, which can reach remote corners, where there is limited scope for TV. The scope of students from remote areas to visit Science Centres, Planetaria may be increased. The no. of Mobile Science vans and Mobile Planetaria and their frequency of visits can be increased. Popular Science Magazines in local languages, already available at subsidised rates, may be sent to interior schools, possibly at highly subsidised rates.

People's Representatives:

India is a democratic country. Policies are made by People's Representatives. Government Machinery is run by a vast network of committed Bureaucracy, overviewed by People's Representatives. They are the persons who interact with people whom they represent. Hence Science should reach them first so that they can appreciate the programmes and in turn take them to the people. They should be briefed about the issues involved and progress in S&T made and achieved. That is the way their outlook will change, at least to a limited extent, help overcome superstition and blind belief, as well as create awareness of Health, Hygiene and Sanitation and protection of the environment.

- At National Level: Members of Parliament; Members of Rajya Sabha
- At State Level: Members of Legislative Assembly, Members of Legislative Council
- At Municipality/Corporation/NAC Level: Councillors, Mayors, Chairpersons
- At Panchayat Level: Panchayats/Sarpanch

Panchayati Raj

The Panchayati Raj is a system which enables people to run their own local Govt in rural areas. It functions at three levels –

The Gram Panchayat at the village level,
The Panchayat Samiti at the block level and
The Zilla Parishad at the district level.

In India, the system of Panchayats is very old. In 1992, the Central Govt. amended the Constitution and formulated rules for the Panchayati Raj System which became effective from April 1993.

The Gram Panchayat has various duties with emphasis on developmental activities such as agriculture, primary education, health and sanitation and responsible for implementing the Community Development Programme at village level.

- The Panchayat Samiti consists of elected members, State Legislative Members and Members of Parliament of that area
- Zilla Parishad, Apex body of the PR System, consists of elected body, MLAs and MPs
- These institutes of Local Self Govt. also help to bring about social change.

Local Self Govt. in Urban Areas

A Municipality or Municipal Council is Local Self Govt. body in smaller towns and cities. The population of a town or city determines the number of members in the Municipality (usually in between 15 to 16). A head of the Municipality is called Commissioner or President.

In case of large cities, the Local Self Govt. body is called Municipal Corporation. The number of elected members is usually between 50 and 100 (may be more as in Delhi and Mumbai–134 to 221). The head is known as Mahapur or Mayor. The functions include:

1. Public Health and hygiene
2. Public conveniences
3. Registering Births and Deaths
4. Education
5. Solid Waste Management.

A Nagar Panchayat is set up for an area that is changing from a rural to an urban type – Transitional area.

State Legislature

Legislative Assembly (Vidhan Sabha or Lower House)–The strength of State Legislature varies according to the population of the State concerned. The total strength for all States/UTs in India is 1485.

Legislative Council (Vidhan Parishad or Upper House)–The strength varies as per the population of the State, limited to 1/3rd of the strength of Legislative Assembly.

Parliament

- Lok Sabha: Maximum strength is 550 + 2 nominated members (530 States and 20 Union Territories).
- Rajya Sabha: Maximum strength is 250.

In the preceding paragraphs, we have mentioned the People's Representatives of various categories starting from Panchayat Raj to Parliament. This indicates how effective our approach would be if they are individually and severally groomed in Science and Technology by way of exposure and training, however short they may be.

Women's Group

Currently with the support from different programs at State and National level, several Women groups have become active and are undertaking activities for socio-economic development.

We may focus S&T communication for this group which will be very effective in achieving our objective. Once women groups are involved in promoting scientific temper, future generations will automatically develop the same attitude.

Scheduled Caste & Scheduled Tribe Group

The SC/ST Group constitutes a significant percentage of the population in several States. Along with the development programs they may be exposed to Science and Technology in an appropriate manner to appreciate the role of S&T for Socio-Economic development and well being besides developing a scientific temper and removal of superstition.

The approach would be to start with local problems/ issues like agricultural production, drinking water, sanitation etc. offering solutions with S&T inputs.

Extract: When seeds and kernel from 5 ripe drumstick are powdered and added to 10 litres of turbid and polluted water, the water will become clean and pure 99.9% of all indicator bacteria will be free. Such proven technologies can be taken to tribal people for whom it is culturally acceptable, inexpensive and ingredients locally available. This is an extract from a book with more than 500 natural coagulants which has been published.

This approach can be followed at Village and Panchayat level.

Corporate Bodies

In addition to the above, there is another group/section that may also be roped in. They are the officers of Major Corporations who contribute to programme of Social Relevance. In fact the Social Corporate Responsibility is now a programme built into the system/organisation. They are already doing yeoman service for the welfare of the society where they are active. All that one has to do is to groom them to bring in S&T inputs into their programs and activities.

Strategy

The strategy shall be to approach different groups suitably, keeping in mind all aspects described earlier. For example, the people's representatives at National level may be groomed about Science & Technology in broader perspective so that, not only can they appreciate the S&T policies at the highest level, but they may also contribute inputs, keeping their areas in view. In turn it would help them in monitoring the efficacy of the system. This would be similar, if not identical, at the State level.

In case of R&D Institutions & Scientists, it would be exposing them to fields of Science not dealt by them, and groom them to effectively take their contributions to the common man. They may also get feedback from the people about problems and issues faced by them and find S&T intervention for solving them.

Taking another group, Doctors & Health Workers, they need not be restrained in their own profession but can be exposed to basic technologies involved in the latest equipments and methods of treatment including latest diagnostic techniques and therapy, application of Nano-technology, Nano-bio-technology, precision medicine, tele-medicine, Robotic Surgery etc. They may also be encouraged to study the unexplored areas and traditional systems etc.

A question may arise whether recruitment and training Role Models is implied in the approach. In a sense it is. Just as NCSTC supports Workshops for "Science Writers", "Folk media", to communicate Science through their arts like 'Pala', 'Daskathia', 'Puppetry' etc., people entrusted with/interested in popularisation of Science can meet, discuss and develop modules for different targeted groups and propagate S&T.

The Communication Institutes under NCSTC/DST can take the lead. Considering the wide range of groups and population involved, and the benefits that is likely to accrue over long periods, the money, manpower and efforts necessary under this strategy is well worth it.

Conclusion

For effective communication of Science and Technology to the public, there should be a mass movement and a Multipronged Approach is strongly recommended.

265. Conservation Governance and Policy Monitoring of Ecologically and Economically Significant Gymnosperms in North **Sikkim Himalaya**

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Abstract. Environmental Conservation address environmental policy, practice, natural and social science at the global level. IUCN has recognized Teesta river basin, harbouring the elegant Gymnosperms in Sikkim as a part of Indo-Burma hot spot. Gymnosperms carry immense ecological, economical, and evolutionary, importance. Present proposal aims to make a study in Northern Sikkim (Lachung, Yumthang, Sevo, Lachen, Yakthang, Kalep and Thangu) for the planning of environmental conservation and management of the 18 species of Gymnosperms. Our main objectives includes, review policies on natural resource management and land-use; Analyse social, economic, and environmental issues and develop a framework of joint action between institutions.

Keywords: Environmental conservation, Gymnosperms, North Sikkim, Natural resource management

Introduction

Biodiversity is the product of spontaneous evolution during million of years. The concept of diversity relates to the species richness in the community. Biodiversity depends upon the intensity, predictability and scale of these interactions and essential biodiversity services to humans with traditional knowledge drive the phenomenon called "life" (Chandra et al., 2010; Obute, 2010; Suleiman et al., 2010).

Environmental Conservation address environmental policy, practice, and natural and social science of environmental concern at the global level including issues of ecosystem change, resource utilization, terrestrial biomes, aquatic systems, and coastal and land use management. Community-based natural resource management (CBNRM) has been a pervasive paradigm in conservation circles for three decades. Despite many potentially attractive attributes it has been extensively critiqued from both ecological and sociological perspectives with respect to theory and practice

(Baral & Stern 2010; Berkes 2004; Blaikie 2006). In focusing on the word 'management' there is very little research into situations where communities are the management agencies (Downsborough et al., 2010; Ashenafi & Leader-Williams 2005; Ko et al., 2010).

Gymnosperms in reference to North Sikkim

Teesta river basin in Sikkim (234 m to above 8,598 m); has deep valleys and ravines to gentle slopes in glaciated valley floors in north making it rich in floristic diversity. IUCN has recognized this region as a part of Indo- Burma hot spot. It also provides habitats and acts as a cradle for speciation and evolution of new species along with the genetic improvement of the cultivated species. The region also harbours the elegant Gymnosperms which are still less researched or untouched aspect in particular line of investigation.

Gymnosperms carry immense ecological, economical, ornamental evolutionary, industrial (aromatic, soap, perfumes, household sprays, floor polishes and insecticides, antifungal and clearing oil) and medicinal importance

(bronchitis, asthma, epilepsy, snake bites and scorpion stings, aphrodisiac, induce perspiration, internal injuries, lung diseases and diabetes, carminative, antispasmodic, remove toxins from the bowel, increase digestive function and cure skin disorders such as eczema and psoriasis; Earle 2008; Shah et al., 2009; http://en.wikipedia.org/wiki/List of herbs and minerals in Ayurveda).

Globalization has ushered in an era of contrasts of fast-paced change and persistent problems demanding synchronization of national policies on a number of issues. An effective response to these challenges will require fresh thinking, refined strategies, and new mechanisms. Henceforth our research asks key questions: (1) How we can do ex-situ and in-situ conservation of Gymnosperms? (2) In parallel, conservation strategies, to promote economic integration in this regard? (3) What are the challenges that national governments face? (4) What institutional structure is needed to manage interdependence and to maximize the opportunities ? An equally rigorous and urgent reform of the environmental governance architecture is imperative. Present proposal is planned to make a study in Northern Sikkim

(Lachung, Yumthang, Sevo, Lachen, Yakthang, Kalep and Thangu) and for the planning of environmental conservation management of the populations of economically and ecologically significant 18 species of Gymnosperms.

The prime objectives for gymnosperms conservation highlight Review policies on natural resource management and land-use emphasizing the gaps; Analyze social, economic, and environmental issues; Develop a framework of joint action between institutions in order to develop protected corridors, taking community participation as the key element; Establish proper priorities in terms of scarce resources allocated wisely in relation to education, or enhanced monitoring and observational systems; Recognize Culture, heritage and social structures in resource management and Enable Markets to work, as the prime land and shelter delivery mechanism.

Methods

Exploration in North Sikkim (Fig. 1). Despite having less forest cover (30%) North Sikkim is at top with respect to the number of flowering plants or number of endemic and threatened species of flowering plants mostly covering the area of particularly in Lachen-Lachung valley and Zemu valley. In recent times, the increase in human population as well as increase in various developmental activities have posed a serious threat to the floristic diversity of Teesta basin.

Fig.1 Locality map in North Sikkim

Analysis and monitoring of policies and institutions for their socio-economic and environmental impact, relating to Gymnosperms belonging to North Sikkim Area

(a) Linking environment and gymnosperms conservation and economic growth

To devise more sophisticated and realistic policy approaches for allocating resources for Sustainable economic growth which is depending on the level, quality, and management of natural resources (R), environmental quality (E), and institutional governance capacity (I).

(b) Priority setting and strategic planning

(i) Assisting partners to more effectively plan strategically and develop environmentally related policy and

institutional governance programs

(ii) Engaging the participation of relevant stakeholders in planning initiatives, including the private sector, with special attention to participation by traditionally under-represented groups, such as women and indigenous people, spiritual or cultural incentives. of policies

4

(c) Dissemination of Environmentally Related Policy Knowledge Communications and Research

• Strengthening the governance capacity of local governmental and non-governmental organizations Institutional information dissemination vehicles, including but not limited to, publications, seminars, workshops and the internet.

(d) Policy Analysis and Dialogue Support

• Issue Recognition: Identifying and analyzing policy constraints and opportunities;

• Issue Diagnosis: Analyzing the economic, social, ecological and institutional aspects of alternative

policies;

Issue Design: Analysis of alternative intervention strategies, approaches, and incentives or dis-incentives

- to change behavior.

(f) Policy Performance Monitoring and Evaluation

- Assisting partners to design and implement policy program monitoring and evaluation activities, both to promote adaptive management and to document results.

Observations

In Sikkim Himalaya, a total of 18 species of gymnosperms are recorded in Teesta river basin. Most of these species are trees except Ephedra sp. and Cycas pectinata, distributed mainly in Lachen-Lachung valley, Thangu region, Yumthang, Dzongri and Chhoka areas (Table 1).

Table 1 Gymnosperms of Sikkim Himalaya (www.sikenvis.nic.in/CCSOTB/Vol-VI_Socio- Expected outcome (Including tentative titles of articles/ reports/ workshops):

Species	Family	Ver./Nep. name	Alt. (m)	Habit	Distribution in Sikkim	Uses
Cycas pectinata	Cycadaceae		600-1050	Shrub	Singtam	Stem pith used to produce sago
Pinus kesiya	Pinaceae	Thakal	800-1000	Tree	Sangklang	Timber and resin
P. roxburghii	Pinaceae	Khasia pine	1000-1800	Tree	Rangit and Teesta valleys	Timber; trees tapped for resin
P. wallichiana	Pinaceae	Dhup	1700-3300	Tree	Lachung	Timber
Larix griffithiana	Pinaceae	Dhupi	2600-3600	Tree	Zema, Yumthang	Timber
Picea spinulosa	Pinaceae	Balge Salla	2400-3000	Tree	Lachen	Timber
Tsuga dumosa	Pinaceae	She	2400-3000	Tree	Chhaten, Lachen, Zema, Chhoka	Timber used in house construction Timber
Abies densa	Pinaceae	Tengre Salla	2950-4000	Tree	Yathang, Yumthang	
Cryptomeria japonica	Taxodiaceae	Gobre Salla	1500-2500	Tree	Damthang, Ravongla	Timber
Cupressus corneyana	Cupressaceae	Dhupi	2500-3000	Tree	Rhenok	Timber for dzong construction
Thuja orientalis	Cupressaceae	Tsendeng Shing	1600-2000	Tree	Gangtok	Timber
Juniperus recurva	Cupressaceae	Morpankhi	2900-4200	Tree/ shrub	Chhangu, Thangu	Twigs and leaves used as incensematerial
J. squamata	Cupressaceae	Shupo Shing	3200-4700	Tree	Thangu	Twigs and leaves used as incense material

J. pseudosabina	Cupressaceae	Shupo Shing	3500-4500	Tree/ shrub	Yumthang, Zema	Wood as incense material
Podocarpus neriifolius	Podocarpaceae	Kaalu Shupo	900-1400	Tree	Lower Teesta valley	Timber
Taxus baccata	Taxaceae		1800-2700	Tree	Lachung, Tholung	Used medicinally
Ephedra gerardiana	Ephedraceae	Dhengre Salla	4000-4500	Shrub	Thangu	Plant contain ephedrine; used in treatment of asthma and cold
Gnetum montanum	Gnetaceae	Shomlata	270-800	Tree	Lower Teesta valley	Timber

- Enhanced capacities for more effective public services delivery to professional skills;
- Sustainable natural growth; increased life expectancy; social protection;
- Improvements to environmentally sustainable economic management especially in rural areas;
- Favorable environment for market development;
- Better plans, management and monitoring of the environment sector;
- Local communities contribute to and benefit from sustainable use of natural resources.

Articles

Traditional knowledge and Conservation of Gymnosperms in North Sikkim.

Novel conservation and policy modeling approaches for sustainable ecosystem and Environmental monitoring.

Development of priority concerns and potential health and education interventions.

Reports (Biannually)

- Conservation Governance and Policy Monitoring of Ecologically, Economically and Evolutionary Significant Group, The Gymnosperms - A Scenario in North Sikkim Himalaya.

Workshops

- Gymnosperms, Population-Poverty-Environment Linkages in North Sikkim.
- Community Based Environmental Management in Lachen – Lachung Valley, The Impacts and Spheres of Influence of the Conservation Program.

Collaborators: Forestry, Soil conservation, Ministry of Enterprise & Employment (MEE). Tourism, Environment & Communications; Economic Planning and Development (MEPD): Population issues, Finance (MoF): Land related Revenue Collection, Information Management; Natural Resources and Energy (MNRE): local NGOs, Universities in Sikkim, BSI Sikkim.

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266. Looking into the Theoretical Development of **Science Popularization Studies in China**

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Abstract. Science popularization, or science communication, holds its ground as a favorable cultural device long since the coming out of new China, but it was not until 1980's that science popularization studies in China stepped into the stage of theoretical integration.

This paper is intended to 1) briefly review the scenarios of science communication for the public in a span of 60 years in different cultural contexts, 2) trace down the developing path of science popularization studies at theoretical level by discussing the focusing issues occurring in the period of theoretical integration, 3) summarize the basic characteristics of science popularization studies in China.

Keywords: Science popularization, Science communication, Theoretical development

Introduction

Science popularization is a historically preferable phrase in China referring to the prevailing cluster of new concepts such as science communication, PUS, scientific culture, etc. The science popularization studies in China launched somewhat late as compared to the developed countries, and there are rather big gaps in depth and width in theoretical studies. Some researches are still at the level of narration of practical facts trying to find out some regularity, while there do appear some reserches containing factors of theoretical analyses.

Division of Historical Development of Science Popularization Studies

Based on the references of divisions of science & technology history and science popularization development, the evolution of theoretical research on science popularization in China can be divided into three periods: "awareness of science popularization" period from the end of 16th century to 1949, "understanding of science popularization" period from1949 to 1978 and "theoretical integration" period from 1978 till now.

The first period witnessed the coming out of science popularization. During this period scientific knowledge of western society spread eastbound and was localized gradually by Chinese culture. It started from the idea of "Chinese culture the body, western science the limbs", then went further to the belief of "save the country with science", "scientism" and finally went to stillness in war times. The practicability and functionality of science were over emphasized in this period, while the value of scientific thoughts was not fully understood by the ordinary people. Nonetheless, it opened the door for science popularization in China.

In the second period, science popularization was carried out in the working pattern at national level. There were big steps in science popularization in China since the government provides beneficial conditions and powerful supports for the development of science and technology. Science popularization theories began to draw nutrition from the practice by summarizing successful experiences. Items concerning science popularization in science and technology policies were made and discussions about science popularization work were held intentionally in which theoretical factors can be found.

The third period is a consciously developing period of science popularization study. Influenced by the western science and technology communication theories, Chinese scholars and researchers started to learn and introduce western theories and try to merge local study with imported ones, that is, to analyze Chinese science popularization practice applying advanced western theories.

After the National Science Conference in 1978, some researchers put forward the thought of construction of "science of science popularization", that is to say, making science popularization a separate research domain.

Around 1990's, the first proceedings of science communication study were published and the theories of public understanding of science were introduced into China to the moment. Together with the rise of science and technology communication study brought along by Communication Science, a distinctive theory system of science and technology communication in China has come into being. This system was based on both critiques of "traditional science popularization" thoughts and absorption of western theories by university scholars.

As it entered into 21st century, another hot spot appeared with the issue of Law of the People's Republic of China on Popularization of Science and Technology (2002) and the Outline of the National Scheme for Scientific Literacy (2006). Studies on interpretation and promotion of "public scientific literacy" rooting in the measurement of which become the core subject of theory research on science popularization.

Theoretical Integration of Science Popularization: Multi-Dimensional Research Field

The science popularization in China entered into a new period after 1978. The contents, approaches and methods in science popularization study are very complicated without a common clue since there is very close connection between science popularization and science of communication, education, sociology and anthropology, etc. Discussion in this part is about the representative issues drawing the attention of most researchers in different developing periods of time with the new ones emerging but not substituting the old ones.

Attempt to construct science popularization as a separate discipline

Based on the experiences and lessons learned in science popularization practice in more than twenty years, construction of science of science popularization was proposed when science popularization began its redevelopment after 1978. Although the first monograph on science of science popularization was not published until 1989, there was already an article titled Probing into science of science popularization expounding what science of science popularization is in 1979, which initiated the study on how to construct the science of science popularization.

It was written in the article that, "There's special rules in realizing speedy, correct and most effective popularization of different scientific knowledge and techniques for different objects, which has become a particular science." Considered the differences between science popularization and other sciences, it was concluded in the article that, "The science of science popularization is a traversing science which studies the popular and common phenomena extracted from all other sciences." Two kinds of researches were suggested to be studied, one is theoretical research, and the other is applied research. The contents of the former should be the history, position, function, motivation and cognizing discipline of science popularization, while those of the latter are the different patterns, rules and approaches of science popularization practices. The practices here include but not limited to science popularization propaganda, education, exhibitions and so on. In further discussion, science of science popularization was also defined as "a science studying and revealing the rules and corresponding dialectical relations of science popularization, and the way to grasp and apply these rules and relations for more effective science popularization."

Inspired by Probing into science of science popularization, monographs such as Introduction on Science of Science Popularization, Conspectus on Science of Science Popularization and Science of Science Popularization were published afterwards. Some intended to construct the theoretical systems and practical patterns for modern science popularization based on the modern sociology, modern science of education and modern science of communication. Basic problems encountered in theoretical construction and development of science popularization were summarized, systematic process and main factors including backgrounds, purposes, undertakers, objects, contents, conveyers, effects were analyzed for modern science popularization.

All these books differed from each other mainly in the degree of influences they received from modern theories of public understanding of science and communication of science and technology due to different times. With no fundamental difference exists in their logics and arguments, they have the following points in common:

(1) They all try to string the practices and theories of science popularization together by a certain system, which reflects the cognition of researchers on the systematic and disciplinary characteristics of science popularization. The simple and plain understanding in the past has become multi-dimensional, leading to more complete and integral understanding of science popularization. However, the logics supporting the system are still vague, without enough analysis and links between science popularization and the nature of science as well as popularization practices and mechanisms. Thus, these systems looked somewhat like a cabinet with lots of things stored in it, instead of a big tree with stems and branches.

(2) As the inheritance and enhancement of the science popularization study in the second period, the study of science of science popularization in these books unavoidably has the feature of macroscopic and top-down standpoint. The attempt to fit science popularization into a systematic framework continued from 1978 to 21st century, but mainly from the vision of science popularization undertakers (government or related organizations) and considered the science of science popularization "a science to study the rules of relay, popularization and pass-on of knowledge and

techniques". Even some analysis and researches went deeply into certain aspects of science popularization practice, the theoretical study in these articles could not surpass the preset boundaries due to limited standpoints.

(3) With the emphasis on absorption from Communication Science, these books were somewhat superficial in "copying" the theories of communication. Although these studies made great improvement to previous achievements, nevertheless they were of constrained vision and depth. Such science communication studies in the form of "simple combination of science communication concepts with the theory" can easily been observed in many research papers.

Reflections on and inceptions in traditional science popularization ideas

After the introduction of public understanding of science into China, some scholars considered that "science communication" should be used instead of "science popularization" because the former has a broader vision and more profound contents as compared to the latter, and fits better with the nature of science popularization at new times. There's also another consideration saying it is not necessary to go to the extremity of completely replacing "science popularization" by "science communication" because selection of terms is less important provided that new ideas and thoughts can be included in the term being used. Lots of things could be done by expanding the original concept even under the same term. In fact, these considerations reflect that the concept embedded in the term "science popularization" has had constraints on its application, therefore new ideas should be added to it. The following three points explicitly summarizes the new ideas: (1) Science popularization should develop from one-way popularization to two-way interaction. On the one hand, scientists deliver scientific knowledge to non-specialists; on the other hand, the public participate in the creation of science, the formulation of science policies and the construction of scientific systems, and interpreting the role of science in the society together with scientists. (2) Science communication is not only a measure applied by the scientific community to reach their purpose, nor a unilateral one-way activity of the nation, but the figuration and construction of culture. (3) The science communication process is a process of convergence of science and humanities.

The proposition of rename is opposed by some other scholars for different reasons. Some take science communication as a concept with broad contents including not only science popularization and scientific news, others find that science popularization emphasizes result while the science communication emphasizes process, thus they could not replace each other since they are not equal logistically. These debates showed different understanding on the contents, purposes and positions of science popularization, and brought new contents to the concept of science popularization as time passed by.

After looking into different definitions of science popularization these yeas, we found that the contents of science popularization are basically four scientific things, i.e., scientific knowledge, scientific methods, scientific thoughts and scientific spirits. (In fact, science popularization in China for all these years put much more emphasis on popularization of scientific knowledge than the latter three.) The way of science popularization is referred more to communication but without detailed explanation (which reflects our weakness in science communication study). The target audience has always been the public, while the purposes are enhancement of economy and culture by improvements of individual's scientific literacy. Though there lack some description of the main body of science popularization, transformation from government guidance to public participation and interaction could possibly be noticed. Big changes are the emphasis on understanding of the relations between science and society, and the requirements on public abilities to participate in public scientific affairs which showed science, society and individuals have gradually become the important subjects in science popularization studies.

In fact, there existed for a long time the debates on science popularization and science communication, which gradually lead to analyses on stages of science popularization and arguments on their models and standpoints. Professor Liu Huajie from Peking University pointed out two traditions in science communication in China: (1) science popularization; (2) science journalism. Followed the first tradition, there are three stages in science popularization: traditional science popularization, public understanding of science and science communication. Their communicative models and standpoints are shown in the table below.

Table 1. Models & standpoints of public communication of science

	Models	Standpoints
Traditional science popularization	Central broadcasting	Of Nation (or Party)
Public understanding of science	Deficit model community	Of Scientific
Reflective science communication	dialogue (or participation)	Of citizen (or humanism)
Trends	with feedback and participation	Multiple coexistence

According to Liu Huajie, the 1st model was used in planned economy times for the needs of nation and governments. It emphasized on academic authorities and scientific beliefs, paid more attention to knowledge and techniques, but less to scientific methods and processes, say nothing of social operations, limitations of science and faults of scientists. The science popularization perceptions in this model derived from the mainstream ideology and combined the science popularization practice with the need of production and construction, which resulted in a unified mechanism of science popularization under centralism. The second model is science popularization or communication with preset scientific authority and ignorance of the public. And the science popularization practice in this model targeted on the improvement of public scientific literacy as well as public support to scientific work. The third model is characterized by diversity of audience and main bodies, emphasis on public attitudes and right of expression, consideration of social justice and fair distribution, etc. In his opinion, the science communication ideas in China lie between first and second models, with a transition to the third model to some degree. The three stages and their models neither appear in sequence, nor grow upon in grades, but coexist at present with respective emphasis. The reality tells us science communication is a multi-dimensional concept in multi shapes.

The analyses of three-stage division of science popularization revealed the humanistic perspective of science communication study, answered the questions of what to communicate (first or second order/first and second order) and why communicate (people oriented), but lacked discussion on how to communicate.

The study on science communication mechanisms became important when the concept of science communication was accepted by more and more people and even brought about the expansion of the connotation of science popularization, but study in this field in China is limited to some analysis and researches on western theories.

In Models of Public Communication of Science in the Background of Communication Theory from Europe and America, the author concerns about the research of MPCS in Europe and America. He classifies theories about MPCS to three kinds, i.e. traditional models, alternation models and some new models in the background of media-isolation. Generally speaking, MPCS undergo a process from linear models to divergent models, and then to web models. There are many backgrounds and hypothesis in this process, which are worthy of studying. Traditional models (canonical account models and others) were put forward after the institutionalization of science. In these models, the “simplified” science knowledge is diffused to the public through the media, which is simple but of defects. The criticism comes from two ways: on one hand, psychology research proved that when the public learn about science, it’s a rather active than passive process; On the other hand, some scholars find out that the boundary between science and common sense is not as clear as the traditional models said. They think that science communication is not only a kind of communication but also a part of science, and PCS is the last process of the science communication. The relations between the media, science and the public become more and more complex with the development of media. John Durant’s model shows the interaction between media and the public. Web model by Bruce Lewenstein proves that the complexity of communication leads to the informational instability. In Peter Weingart’s opinion, science means intermedia, and the media has replaced the monopoly station of the science.

Except for the above mentioned dissertation, there are other articles giving deep and detailed analyses of models and theories of public understanding of science. There’s one paper exploring division of science communication models in terms of dissemination structure, called respectively vertical communication, diffused communication, hierarchical communication and feedback communication, etc. However, there is still short of studies on mechanisms coincide with actual situation and helpful for science popularization practice in China.

If we make a simplified summarization of the concerns of science popularization studies in this period (the real facts are much more complicated), we will concentrate on three aspects: the contents, purpose and mechanisms of communication. The communication contents (what to communicate) changed from mere “positive” scientific

knowledge, which was considered self-evident, to cognition of the importance of scientific methods, thoughts and spirits, as well as doubt on the authority of science. The communication purpose (communicate for what) changed from governmental needs to the proposition of public needs. And the communication mechanisms (how to communicate) emphasized on the exploration of functional communication models, with lack of study on effective mechanisms.

Studies on public scientific literacy

Followed and accompanying the attempts to construct theoretical systems for science popularization and the reflections on traditional science popularization, many researchers show their interest in study on the promotion of public scientific literacy aroused by the survey of public scientific literacy.

Around 1990's the study on public scientific literacy in China began with the introduction of the results and systems of the survey of public scientific literacy by Jon Miller. Then seven investigations were carried out respectively in year 1992, 1994, 1996, 2003, 2005 and 2007, with the eighth one going on now in the whole country. Originally the surveys were done applying the whole set of measuring tools of Miller's from the basic theory to the methods.

After years of development, we have had our own thoughts and studies at the theoretical level based on our learning from the surveys and absorption of advanced theories of public understanding of science. These studies include both applied research directly related to and theoretical research indirectly related to the survey. For the former there are studies on the index of public scientific literacy, sampling, and weighted calculation, etc., for the latter there are analyses on concept and contents of public scientific literacy and studies on related communication theories. For example, in the doctoral dissertation Research on Theory & Practice of Measurement of Public Scientific Literacy: Take Miller's System as a Clue, Li Honglin establishes an analytic framework to carry out a comprehensive inquiry to theories and practices of the measurement of public scientific literacy based on multidisciplinary research perspectives and a wide range of critical attitudes of STS.

It is explained in the paper why the cognition of scientific literacy and the measurement design of Miller's system deeply reflect the implicitly underlying traditional view of science and the "deficit model" of public understanding of science, as well as how multiple models (e.g. democratic model, reflective model) and concepts (e.g. three paradigms of PUS, civic epistemology) of PUS reflect on the theoretical foundation of Miller's system and contribute to the theoretical evolution of the measurement of public scientific literacy. It is commendable that a stratified measurement structure that combines both "living science" (a new concept suggesting the importance be attached to the combination of living science, academic science and post-academic science) and Miller's system should be adopted in the measurement of Chinese public scientific literacy. No matter better or worse in rationality and feasibility of this structure, the exploring approach and studying vision of relations between public scientific literacy measurement and theoretical models are of value.

Around the issue of Law of the People's Republic of China on Popularization of Science and Technology in 2002 and Outline of the National Scheme for Scientific Literacy (2006-2010-2010) in 2006, some studying projects have been launched in order to provide theoretical basis and practical foundations for their formulation as well as further explanations for future implementation.

An example is the Research Analects of National Scheme for Scientific Literacy collecting 21 research reports by 11 teams around the formulation of the National Scheme. The research contents of these studies include: the connotation, structure and situation of public scientific literacy in China, factors influencing the public scientific literacy in China, the purpose and importance of promoting public scientific literacy, ways, mechanisms and environments for the enhancement of public scientific literacy, national standards of scientific literacy for Chinese public, the monitoring and assessment of projects aiming at promoting the public scientific literacy. The achievements of all these studies had their reflections in the guidance and plan of the Outline on the construction of public scientific literacy in China. For example, the public scientific literacy is expressed in the Outline as "knowing some necessary knowledge of science and technology, mastering basic methods of science, building up science thoughts, advocating science ethos and having the ability to apply them to resolve practical problems and participate in public affairs". This is summarized and refined from two reports in the Research Analects of National Scheme for Scientific Literacy. So are the purposes in each implementation stage, the schemes for different groups of people, and the setup of basic science popularization projects.

A large proportion of studies on public scientific literacy are applied research, e.g., the index study in survey of public scientific literacy, and the reliance of the Outline on theoretical study achievements. However, many studies still remain at superficial level dealing with empirical research on science popularization practice. Reasons hidden behind the problems haven't been figured out nor effective resolutions been proposed. For example, though recognized by some researchers, there are no detailed patterns, ways or measures given for the rules of "multi-participation, two-way interaction and alternate integration" which should be obeyed in the promotion of public scientific literacy.

Conclusions

The characteristics of science popularization studies in China are figured out by combing its theoretical development and analyses of typical issues. The features are summarized as follows:

(1) Science popularization studies in China is undergoing the period of accumulation and integration of theories. But the advancement develops slowly possibly due to the lack of an flexible and open system and advanced research methods.

(2) The multi-disciplinary interaction in science popularization or science communication studies is very obvious. Influences on the theoretical study of science popularization in China mainly come from public understanding of science and science of communication.

(3) There are lots of macro level studies while lacking micro level ones.

(4) Equal emphases are paid to theoretical and practical studies, but there's not many in-depth and detailed case study.

(5) The influence of traditional science popularization study patterns result in much more studies from point of view of the main body than those from the angle of target audience.

(6) The study on science popularization mechanisms need to be strengthened.

267. Experiences of Jana Vignana Vedika in Communication of Science and Technology Among the People in Andhra Pradesh

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Science and Technology Communication

Our Constitution prescribes Developing Scientific Temper, Humanism and Spirit of Inquiry and Reform as some of the fundamental duties of every citizen. Popularization of science and inculcation of scientific temper among the people is one of Jana Vignana Vedika's (JVV) major tasks and priority areas. Its modes of popularization of science among people include folk arts, street plays, dance, magic, sound and music and other art forms besides the usual speeches, book exhibitions, demonstrations, debates, presentations, mobile science laboratories, gauntlet challenges against baseless claims, etc. Some of the activists of JVV regularly contribute articles and science features in vernacular dailies and magazines besides participation in electronic media and AIR. JVV has developed a series of radio episodes on 'Chemistry in Daily Life' (13 episodes of 30 minute duration), 'Emergence of Modern Science'
(another 13 episodes of 30 minute duration) and 'Mana Nela Mana Bhoomi, meaning Our Land and Our Earth (a 52 radio episodes of 30 minute duration, developed in connection with the International Year of Planet Earth, in 2008) and other areas of science with a collaboration of the DST's Vigyan Prasar and All India Radio. Whenever astronomical events such as eclipses, meteors, comets, occultation's, etc. occur, JVV would be the first to go to people at their habitats and make them understand the underlying principles of such phenomena lest they should attach obscurantist cause to them and continue to be eternal slaves of paranormal and superstitious belief systems. Further, during events of calamity, such as tsunami, storms and floods, accidents and other untoward situations, it gears up its human and material resources to go to the material and mental needs of the victims and the aggrieved. Fake god men, soothsayers, palmists, quacks and unscientific medical prescriptions are on the waning due to the protracted activities of JVV. It has been rated the topper in celebrating the United Nations' International Year of Physics, 2005. As a befitting culmination of the celebrations of the International Year of Physics, JVV has installed a life-size statue of Albert Einstein, the genius of the millennium and on the basis of whose scientific works was the year, 2005, declared as the International Year of Physics.

Education

With the strength of several thousands of teachers as its members, the JVV organizes teacher training to make them enjoy teaching and promotes pedagogic innovations to make learning an enjoyable activity for children. In consultation and association with teacher organizations, it holds frequently workshops to enhance the teachers' information on the latest developments in science and technology by closeting them to eminent scientists and academicians of premier institutes of higher learning. It also assesses curriculum and textbook contents and concepts and organizes children's science festivals, such as balotsavs, srijanotsavs, joyful learning, bala melas, etc, frequently on massive scales. Further, it has developed PowerPoint slideshows and software modules in several subjects of academic interest besides lecture notes and booklets. To promote quest for knowledge and bent of socio-scientific and technological awareness among school children, JVV conducts Chekumuki Science Talent Test every year for high school children. As many as 6 lakh students have participated in this test during the year, 2007. The state level chekumuki science talent test, known as Sainsu Sambaralu, is not a competition but a festive convergence of bright minds from all over the state. It is marked by the so-called, Science Carnival, in which science toys, science shows, science demonstrations are staged all along roads.

The adult literacy, neo-literacy and post-literacy programmes, JVV organized, have brought praises to JVV from many corners. The mobile science laboratories (with help of DPEP), workshops on Low-Cost and No-Cost Science Teaching Aids, activities by name Joy of Learning, Summer Camps and Winter Camps for school children and teachers, etc some of the other very acclaimed activities of JVV in the Educational front.

Health

Over the last few decades, JVV has actively been campaigning for people-oriented health policies and medicare. Led by a band of dedicated doctors and activists, the organization conducts surveys and analyzes the ground realities of health care at all levels while preparing village level health plans and cost-effective and lasting solutions. As an active partner of Jana Swasthya Abhyan (People's Health Movement), JVV has been critically examining the health policies of the governments and formulating alternative health policies while cooperating on certain areas many were baptized to JVV when there was a Prohibition in the state of Andhra Pradesh. It was the Literacy Movement, spearheaded by JVV, and one of the many short stories written by JVV for the illiterates, that sparked the Anti Arrack Movement. It has been a milestone in the successful chronology of events of Jana Vignana Vedika. JVV has been organizing workshops and conventions to impress upon the people and the polity that giving healthcare to everyone is State's responsibility as per the Alma Ata Declaration, which stated "Health for All by 2000 AD". It also conducts seminars on various issues related to health such as HIV/AIDS, PC and PNDT Act and general public health awareness. It brings into light some of the unscientific and corporate-based health policies and strives to protect the PHCs.

It vehemently fights against the misuse of medical technology for looting people's purse and against unethical practice of sex determination and organ trafficking. It holds health camps and health-awareness programmes frequently all over the state. It fights against spurious drugs, quacks and clinically unfounded medical claims. It emphasizes the need for medical research towards lasting remedies for epidemics, gross ailments, community healthcare, rural hygiene, women and child healthcare and social and preventive medical systems. It welcomes traditional methods of medical practice for scientific scrutiny and physiological causative verification so as to be mounted on unquestionable scientific disposition.

Publications

One of the major strengths of JVV is its publication wing. To promote quest for knowledge and love for science and technology among school children, the JVV has been running the largest circulated Telugu children's science monthly magazine, Vidyarthi Chekumuki, since 1990. In addition, it has been publishing and circulating different kinds of books on science, culture, history, education, health etc. for all levels of people. Promotion of reading habit among children is a regular and ongoing activity of JVV. It organizes book exhibitions, reading festivals and readers' clubs. Most importantly, it publishes and circulates booklets, pamphlets, science bulletins, science calendars and diaries. It has brought more than 300 titles on various socio-scientific topics and on popular science. It also runs Jana Vignanam, the JVV's organizational monthly.

268. Innovative SF and Mythology Mix to Communicate S&T to Indian Masses

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Abstract. With the help of improvised cultural tableaux by judiciously blending sf and mythology during festivals like Durga Puja and Dussehra we successfully tried to attract illiterate Indian masses in order to communicate S &T perspectives and developments. Some model tableaux were as follows:

A. Tableau showing concept of Cloning: With the help of a mythological story popularly knows as 'Raktbeej and Mahishasurmardini' (Demon vis a vis a Hindu goddess Durga) and sf extrapolations on cloning we explained the process and implications of the emerging technology to illiterate people .

B. Tableau of Biotechnology: The science fictional biotech tree akin to mythological 'wishing tree' (Kalpvriksh) demonstrated the hidden potentials of biotechnology.

C. Tableau depicting water harvesting technology: Traditional techniques of rain water harvesting and its necessity as narrated in Hindu myths notably the efforts of sage Bhagirath to bring the river of gods i.e. river Ganges on earth.

D. Tsunami Tableau: Awareness and preservation of natural mangroves is the key to safety from killer waves was demonstrated with the help of many catastrophe models as described in sf stories and myth of Lord of death i.e. Yamraj. It was established that Sf stories with a judicious mix/blend of Indian myths could be effectively used through attractive tableaux to communicate science and technology to illiterate masses that do not have access to modern means of communication. A similar approach could be replicated in other parts of the globe.

Keywords: Improvised tableau/tableaux, S&T communication, science fiction and mythology.

Introduction

India currently has the largest illiterate population of any nation on earth. Approximately 35% of world's illiterate population is Indian and based on historic patterns of literacy growth across the world, India may account for a majority of the world's illiterates by 2020.This is also the major group of people who do not have access to many modern means of knowledge communication .This poses a great challenge as how to communicate S&T effectively to these people.

Cultural tableaux are prominent crowd attractors during festivals like Durga Puja and Dussehra in India. Thousands and thousands of people throng to behold the glimpses of cultural India depicted through these tableaux. Our endeavor culminated in making beautiful and impressive tableaux which incorporated judicious blending of both cultural elements and science to easily attract lay people and then to spread the message of science spontaneously during these festivals .While science is purely an objective exercise, science communication entails the subjective / cultural perspectives also. So unless some cultural angle is not employed the mass communication of science in India shall remain largely less effective especially to illiterate people.

Impressed by imaginative and prophetic/visionary elements of Indian mythology with which even an ordinary uneducated Indian citizen is very familiar, we devised an experimental design combining mythology and sf in order to effectively communicate S&T among illiterate masses. By carefully amalgamating myth with certain breakthroughs and future possibilities in the field of biotechnology and other scientific disciplines as narrated in many sf stories we made attractive tableaux to lure the public and then inculcate amongst them the temper and wisdom of science.

Methodology

Improvised tableaux were made on themes like cloning, trans-genetic crops, water harvesting technologies, tsunami etc with the help of professional and skilled artisans and were exhibited in Puja Mandap(earmarked places for tableaux exhibition) during the festival seasons . A feedback response was obtained from the people who visited these tableaux in order to ascertain the utility and importance of this innovative endeavor for popularization of science in eastern belt of U.P. Feedback forms drafted with aim to an easy comprehension by target groups contained 10 objective type questions covering a broad range of issues related to science communication. The analyses of feed-back response were done.

Results and Discussion

Science fiction as we know today is all about strange new ideas and imagery, i.e. the same elements which also characterize mythological stories. It's for this reason that SF/F buffs are usually tempted to draw analogies between science fiction and mythology. Both science fiction and mythological imaginations at times, anticipate scientific and technological developments. It is in the very nature of sf that it usually deals with the non-existent social set ups, technology and gadgetry, etc. making the genre quite analogous to myths since the latter is also known for its depictions/descriptions of imaginary things and people.

Indian mythology as contained in Hindu scriptures abounds in imaginative ideas and human values. Carl Sagan was very impressed and inspired by these sources of ancient knowledge. He once appealed sf writers to delve deep into Indian mythology to get original sf theme ideas.

Quite interestingly there are extrapolations, imaginative themes, and descriptions of gadgets often in contemporary sf and in Indian mythology alike. For example, Puspak Viman--a special kind of aero plane which possesses a vacant seat for any last minute VIP entrant! (Remember Rendezvous With Rama by Clarke?) Sudarshan Chakra (a kind of revolving disc) and arrows used by Lord Krishna to kill enemies returned back to them just after hitting the target (the same concept as in guided missiles!). In Maya Yuddhaa (some kind of virtual war) as described in the epic Ramayan while no real damage is done all enemy soldiers get frightened and surrender owing to horrible virtual projections and imagery of all sorts! Trishanku--a celestial body which is said to have been projected into space by an ancient sage Vishwamitra. An imaginative leap of our ancestors which indicates that the sky could be conquered by man one day! This legend in Indian mythology that Trisanku is hanging in the sky between the heaven and the Earth, though regarded as incredible, has fascinated one and all since time immemorial. Now we all know about the Lagrangian points which are the five positions in an orbital configuration where a small object affected only by gravity can theoretically be stationary relative to two larger objects (such as a satellite with respect to the Earth and Moon). In 1945, Arthur Clarke also wrote in an article published in Wireless World that placing three geostationary satellites (Compare Trisanku!) above the equator would revolutionize global telecommunication. A mythological idea that objects can be made to appear stationary above the Earth found a place in science fiction. In 1964 the first Trisanku (!), Syncom, with the generic scientific name geostationary satellite/geosynchronous satellite was placed above a fixed longitude on the equator, which explicitly justified the power of prophetic vision inherent in Indian mythology.

It was showed for the first time that science fiction can effectively teach science to lay people who do not have access to other forms of communicative broadcasts. Peggy Kolm has referred to this innovative approach in Biology in Science Fiction and also mentioned that in the U.S. there seem to be some teachers who are using science fiction books and movies - both with good science and with bad science - to teach basic scientific concepts.

In our study sample about 70% audiences were from villages and 20% were from slums of town/city surroundings and remaining 10% from small settlements who thronged to see the S & T tableaux erected/shown during the festivals. Tableau shows in question were significant in disseminating S & T knowledge intended for the target audience and were also useful in dispelling many orthodox beliefs as was evident by the replies recorded. Majority, i.e. over 90% viewers replied that they were having many misconceptions before observing these tableaux. 70% of the target viewers were of the opinion that the tableaux were most effective form of science communication for them. Only 20% had access to broadcast media i.e. Radio, T.V., cables etc. Majority opined that folk/cultural/traditional and public relation and interpersonal contacts were more effective for them to comprehend S&T related issues.

When audience were asked that whether they were convinced to help spread further the spirit of science, their responses were affirmative and they told that were fully convinced to spread the scientific knowledge in society after seeing these tableaux. When they were asked which scientific subject was more useful in their opinion 60% told it was biological/ medical Science, 15% were in favour of agricultural sciences and equivalent number of participants voted in favour of environmental sciences. Other remaining groups constituting 5% each opined that Earth/Physical Sciences and general sciences were more useful to them.

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VI

Science Communication : Debating Diverse Areas

269. Why INO Progress is Slow? – A Case Study

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Abstract. A well planned programme of any kind will face fewer obstacles if not no obstacles at all at various stages and from various stake holders of the society. This statement needs no proof. The India-based Neutrino Observatory (INO) Project is one of the examples of scientific faith, the international community of scientists; have on Indian scientists and India's S&T Programmes. This is one of the unique projects which will fulfill one of the dreams of Pandit Jawaharlal Nehru come true. The INO project is proposed to be set up in West Bodi Hills near Pottipuram Panchyat Union in Theni district, Tamil Nadu, India. The Rs. 900-crore prestigious project's implementation is slow, as the residents of the village, the NGO groups and Human Rights Activists pose stiff opposition towards the implementation of the project. The rural public has been educated more about the properties of neutrino by NGOs and Human Rights Activists than by scientists, science communicators or science-based-institutions in this region. We conducted a study with the help of our students and the result points out that the slowdown in the implementation of the INO project is mainly due to the absence of effective S&T communicators who ought to have been a confidence building bridges between the project implementation cell and the rural public, NGOs and Human Rights Activists. In this short presentation we will also share some more areas of concern that have slowed down the progress of the INO project.

"The customer is always right"–Mahatma Gandhi.

270. Environmental Aesthetics and Environmental Education in China: Status in quo, Problems and Future

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Abstract. The Study of environmental aesthetics in China begins with the translation of related western works of environmental ethnics and environmental aesthetics in 1980's. From beginning of this century, integrated with Chinese traditional philosophy, a new turning of the study of environment was formed, focusing on aesthetic view on nature, ecological critics, and aesthetics of landscape. The environmental education in China begins with early 1980's. The Chinese environmental education has some characters. First, it is a kind of non-systematic and marginalized education, which resulted in incompleteness and arbitrariness. Second, although the environment education penetrated in different levels and areas, with lack of theoretical guiding, it focus on introductory and popular but not original and individualized education. With the gradually appreciation of the importance and value of environment, the education of aesthetics of environment eventually will become important part of the environmental education. In Chinese traditional views of culture, related to human and nature, or human and environment, there are many theories could be borrowed and integrated into the education of aesthetics of environment. We can forecast that application of environmental aesthetics in environmental education will has bigger and bigger space.

271. Catching Them Young: Inspiring Budding Researchers for Better Science Communication

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Abstract. Science exists because scientists communicate; however, the communication of science is often seen as a necessary evil by most scientists. A national level undergraduate research conference ICARUS (Indian Conference for Academic Research by Undergraduate Students, http://icarus.org.in) was organized at IIT Kanpur to provide a forum to communicate and celebrate undergraduate student achievement in various fields of science and technology. A unique opportunity was given to the undergraduates across the country to present their ongoing research, at any stage of completion, in a public format to their peers, and the importance of good science communication was stressed throughout the conference. An introductory workshop on science journalism and communication was organized for all 88 participants in the conference. The vision of expanding and publicizing undergraduate research and inspiring the participants for better science communication was realized. NERD (Notes on Engineering Research and Development, www.iitk.ac.in/nerd), the campus science and technology magazine of IIT Kanpur, also expanded its domain of activities to promote science communication among students. SCoPE (Science Communication and Public Engagement) talk series was initiated. Distinguished science journalists and communicators were invited as speakers, who, from their expertise, shared their exemplary work and excitement, and gave the students a glimpse of what does science communication and popularization mean in the Indian context. Last but not the least, workshops on science journalism and communication were conducted in various institutes – IIT Kanpur, IIT Delhi, IIT Jodhpur and IISER Pune to stress upon the need of better science communication on a professional and popular level to truly define the scientific progress of the country.

272. Social Education Policy of the Beijing Regime of the Republic of China (1912-1928)

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The author discusses the social education policies of the Beijing Regime (1912-1928) of the Republic of China and the chain between the popular science and the change of culture. The popular science in social education policy was an important part of governmental education system. At first the charactor of traditional Chinese culture decided its goal and inclination in which S&T had been regarded as a tool for the rule of the upper class. After great president Yuan Shikai failed to crown himself as emperor, the old ruling culture was fully suspected and the ‘new’ S&T culture came out to challenge the old one. The ‘4th May 1919’ movement to pretest the transfer of German concession to Japan really alerted the whole Chinese society that change based on the ‘new’ culture was desperately needed. The conclusion is that popular science was introduced to China a little reluctantly from the late year of Qing Dynasty to 4th May 1919. When it is proved that old culture was ineffective the Chinese would adopt a ‘new’ culture based on modern S&T. So the main stream of Chinese society at that time was tipically conservative.

273. Understanding Science is Making Commonsensible Concept System Scientific at two levels of individual and public –Based on a Case Study of Chinese People Understanding Goldbach Conjuncture

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Abstract. Based on a case study of Chinese people how to understand a Goldbach conjuncture at 1970s, this paper try to explain cooperating mechanism of concept system yielding to individual and public, and probe general characteristics of people how to cognize new scientific concept based on their own original concept system. Public understanding science, (broadly including engineer and technology) relates not only science how to be popularized through mass media or how to improve public scientific literacy but also cognitive level and method applied by a society and its member as well as cognitive social progress. In a micro individual concept systemic perspective, understanding science is making personal commonsensible concept system more scientific; correspondingly in a macro social concept systemic perspective, understanding science is making social commonsensible concept system more scientific then improving progress of social cognition level and method, as well as improving public scientific literacy.

Keywords: Goldbach Conjecture, Concept Cognition, Individual Concpet System, Public Concpet System, Understanding Science

Introduction

Since a literary report titled "Goldbach's Conjecture" was published at No.1 issue, People's Literature, and reprinted full article at Feb.17 People's Daily in 1978, Jinrun Chen, an outstanding mathematician, and Goldbach Conjecture, one of the 23 Hilbert's problems, became hot topic for the public of China at that time. With the gradual penetration of nationwide propaganda to public, more and more people not only knew him and his focus but also enthusiastically believed they can resolve that problem completely based on Chen's research. Jinrun Chen deeply encouraged a whole generation Chinese people, and was thought as a symbol of science. His influence, especially to people's interest in Goldbach Conjecture has been lasted so long time and reached a high tide until 2002. When we reflect this phenomenon today, we must admit that it is a typical PUS case even some persons may argue whether mathematics belong to traditionally scientific issues. In this case, an typical cognitive phenomenon people how to keep balance between the general meanings of mathematical symbolic they are familiar with and the special professional meanings depending on specific context they are unfamiliar were explored. Namely, when scientific terms beyond their original meaning known by people, how do people understand the new meaning with their individual or public concept systems. Additionally, from the perspective of concept system evolution, it also remind us merely standing at the science popularization is deficit for PUS, and is necessary to change our standpoint from scientific concepts popularization to commonsense concepts scientization.

In this paper, we first focus on tracing and comparing how normal people understand such professional mathematical concepts and gradually form fallacies about Goldbach Conjecture based on their quantitative concepts of daily life on one side; and proving that the metaphorical method of concept cognition perhaps is an important method, which play a lead role in forming those fallacies on the other side. Second, based on case analysis of first step, it is obvious when people cognize and understand scientific terms and concepts no matter individually or publically, they consciously or unconsciously apply concept system in different four levels: individual commonsensible concept system (abbreviation as ICCS, following same); individual scientific concept system (ISCS), public commonsensible concept system (PCCS); and public scientific concept system (PSCS). From social perspective, PCCS and PSCS represent public knowledge base; correspondingly, ICCS and ISCS represent individual knowledge base. Third, we explore what kind of cooperating mechanism and what are the different roles among the four levels. The theories of concept cognition already prove that four concept systems exist linear and nonlinear relationship when they interact during a specific cognitive activity. Generally speaking, the higher percent of PSCS and ISCS in public knowledge base and personal knowledge base respectively, the higher levels of scientific literacy in society and individual. Since China never cultivates really modern science and scientific spirit via its native culture from 18 to 19 century, there consequently exists a fracture stage in the proceeding of modernization and cultural evolution. From concept cognition perspective, the fracture stage means more obvious gap among four concept system categories when people take advantage of them to understanding the modern scientific knowledge, methods, function and meaning. Based on above presumptions, the important cognitive function of PUS is dealing with cognitive relationship among four types concept systems, especially leaping over or shorting the distance between ICCS and ISCS whatever for developing or developed country. No matter what kind of scientific concepts are available in their popularization, if we couldn't pay more attention to the importance of commonsensible concepts as the precondition and background of understanding for the public and individual, we are never going to resolve the gap between science itself and understanding to science. Last, it is worthy to emphasize that investigation of concept system evolution in both aspects of public and individual not only support democracy model of science communication and suggest a more operational communication view, namely, surrounding experience of daily life makes more commonsensible concepts scientization.

274. Pride and Prejudice: Science Communication From Within A Science Institute

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Abstract. In a democratic society, citizens must be informed of the latest scientific advances and discoveries which are carried out in science institutes so that they can participate in the debate about the trends science will follow, its applications, its benefits and its risks. This is very important since in many modern states, in particular in Mexico, inside the National Autonomous University of Mexico (UNAM), scientific research is funded with the citizens' taxes.

Science communication should be thought of as benefitting not only individuals who have no direct contact with scientific research, but also scientists. It is important that the latter communicate their projects and discoveries: when they do so, their work gains social recognition, their institution gets exposure, and they are more likely to get funding for their next project. However, as scientists are used to discuss their work only with their colleagues, most of them find communicating their results to the general public very complicated and frustrating. Taking this into account, it is crucial for science institutes to have communication of science offices, run by professionals in the field, which function as a bridge between scientists and society.

Even though many academic institutions in America and Europe have had communication of science offices in science institutes, Mexican institutes used to consider that science communication was trivial and unnecessary. In the last few years, however, some institutes in UNAM have hired professionals to run offices whose tasks include organizing press conferences, writing articles and organizing events aimed at the general public, and doing public relations for the institute, among others.

No matter what the professional training of the communicator of science, they can never be expert in all the subjects of interest of the institute. Hence, the members of the communication team must carry out extensive and rigorous research about these areas, which are of great complexity, and in which they generally have little or no experience. Moreover, they must find the best way to communicate these subjects. In order to fulfill this objective, they need to work in close collaboration with the researchers of the institute.

In this paper, I will talk about my experiences as Head of the Communication of Science Unit of the Nuclear Sciences Institute (ICN) in UNAM, in order to discuss the interaction between the head of Communication of Science and the researchers in an institute. Moreover, I will discuss the process that begins with the publication of a scientific paper and ends with the creation of articles for the general public, leaflets, scientific journalism articles and press releases. I will also mention the way that this process has helped us in interacting with journalists, teachers, students and general audiences. Finally, I will mention how having a Communication of Science Office has positively affected the life of the ICN-UNAM.

275. Research on Audience's Information Behavior of Science Communication

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Abstract. Audience is one of the very important field of Science Communication. As society and technology evolving, the traditional audience of theory is not enough to explain the variety of new behaviors and phenomena. The main research content of the paper is try to use information behavior theory to explain these issues and provide a new method in research on science communication. This article from the perspective of general information behavior theory discuss that the audience's three aspects are information demands, information behavior process and effect factors of information behavior. First of all, audience's information demands are respectively explained the motives of internal factors and external factors; secondly, it is analyzed that the process of information behavior in Science Communication is formed; finally, it is the analysis of these effect factors of audience's information behavior. This paper conducts audience's information behavior in a simple analysis and induction and provides a new perspective for the Science Communication theory.

Keywords: Science Communication; Audience; Information Behavior

Introduction

Whether to investigate the dissemination of results or study the impact of media on the audience, human behavior is always a center of communication problems. Man as "audience" can only receive information in a passive communication process, it is an old point of view on the early study of communication. As early as 1959, scientists Katz's " Uses and Gratifications " theory put forward to refute this. 1980 years, Japanese scholars with a strong "information age" consciousness began to re-examine "audience" in communication and understood the audience from "passive recipients" to "active user." So people start using a new concept to describe the behavior of using and accepting mass communication and that is "information behavior" concept. In the information age with changing and developing of propagation media, the behavior that mass communication theory can not explain and do not include often in people's daily lives, especially since the process of information to form a variety of new communication behaviors, communication theory is the more powerless. Information behavior theory provide a new help to theoretically interpret these problems for us.

According Wilson generally described on patterns of information behavior in 1981(1), based on the traditional information behavior study, combined with the communication and sociological theory, we discuss audience's information behavior of Science Communication in several aspects such as information needs, the process of information behavior and effect factors to explore and enrich the relevant "audience" of the theory.

Audience's Characteristic and Classification

The emergence and expansion of Internet in mid-90s of 20th century, humanity has entered the information age, information technology as an effective means and important ways of social life, all of the scientific and technological achievements have prompted a leap in science communication work, which makes "audience" does not longer be passive recipients of information, but mainly to search for needed information. Science communication is also increasingly from the Public Understanding of Science into the Science Communication. We believe that the audience of science communication are people who are initiative and social, and members of society who expectations and needs of the knowledge about nature and social practice has understood and accepted through effective medium.

Science Communication audience generally classified according to their form factors such as gender, age, education, industry, nature, nature of income and occupational classification. These methods are mainly based on demographic characteristics of the classification, to facilitate the classification of the audience. However, the audience should be broad, including not only individuals but also including the groups, including not only the reality of the audience should also include the potential audience. This paper argues that audience of science communication are classified by the audience's attitude so that we know more about the psychological characteristics of the audience.

First, passive audience. The types of people in the audience at this stage accounts for a significant portion. Most of the features of this group is accustomed to go with the flow, ability to adapt to survive, holding adaptable attitude, not have their own opinion, is the so-called "silent majority." However, the media pay more attention to the group reports, are especially concerned about media changes in national policy on science and the spread of social change from the direction of a look into the depths in order to make themselves more to adapt to society.

Second, active audience. The characteristics of this type is due to the will of the crowd more firm, the ability to accept new things, and a considerable part of a knowledge culture, so they hold more positive about the future attitude of most of them actively participate in science and the establishment of a new social order. And similarly, such people are also concerned about media reports, especially like to accept a lot of information is different with a conclusive report is not blind obedience and replace them with their own thinking.

Third, aggressive audience. The number of such people is very small part, but full of thought and action. This group do not mentioned in age, but have the most characteristic features of knowledge of the group. This group of people have strong ability to accept the world's advanced ideas and culture. Science Communication media is the object impacted and used, and forums which express their views to promote society for them.

Research On Audience’s Information Behavior

Essence of information needs

Information behavior began in the audience aware of their own information needs, and audience will produce behavior because they have information needs. Information behavior research and information needs are inseparable. In general, the audience’s information needs is the audience needs some information to meet their needs. The information needs for three types of science communication of audience is divided into domestic demand and external demand. The domestic demand of information needs of the audience is its fundamental role in information behavior and determines the audience’s information behavior of the object of conduct, process and development. The external demand influence information behavior in two ways, one is to arouse the audience’s internal information needs and thus generate information behavior; the second is to initiate audience to generate new information needs and conduct information behavior .

Process of information behavior

Information behavior is the audience’s action and history to response and meet their information needs.

"Information behavior" theory is interdisciplinary science formed in communication science and information science, which not only covers various elements of the analysis of the media, but also explains more systematically issues of the relationship between media and people. From the traditional information point of view, the domestic definition of audience’s information behavior is that "mainly refers to human use their wisdom to start a variety of information activities which is a series of process of human information inquiries, collection, processing, production, use, dissemination and so on. "(2). Japanese scholars Mikami Shunji believe that information behavior is an action of personal in the social system to use the media or directly to the collection, transmission, storage information, and processing of information. Further more he also proposed the basic model of information behavior . (3)

In science communication audience’s information behavior is mainly the process of produced and accepted scientific information. This article explore information behavior process based on the knowledge which is a typical representative of scientific information. The main way to accept knowledge is reading scientific literature, it is also a process of scientific information received (4). In our view, the four steps which is "reflect - select - Integration - internalized" is not only the interpretation of the process of accepting the scientific literature information, but also suit to explain the process of general acceptance of scientific knowledge. Scientific knowledge is the results of human reason and a kind of information whit processing and refining, also can guide people's practices. So knowledge acceptance generally emphasis on "understanding" and "internalized" these two steps. It should be noted that the "select" is not a separate step, but throughout the entire process of acceptance of scientific knowledge. Accepted scientific information can be summarized into three steps: reflecting - understanding - internalization. Reflecting is the perception and initial understanding of scientific information; understanding is to interpret scientific information and to grasp the essence of the thinking process; internalization is the process confirmed the original scientific information and the full acceptance after practice testing.

Effect factors of information behavior

From the perspective of information studies, many scholars have discussed the factors affecting information behavior: William J. Paisley summed up the eight-factor point of view focused on environmental factors (5); Abdelmajid Bouazza summary view of the three factors (6) focus on aspects of personal characteristics; C.L. Mick and George N.

Lindsey (7) focus on two aspects of personal qualities and interpersonal; Wilson's three-point (8) factors is in line with the actual situation including personal characteristics, interpersonal and environmental factors.

Social science theory said that "all human social behavior is under the influence of the social environment and through learning of model behavior to form, improve or change." (9) The critical factor of human behavior that person factors and environmental factors play a role not in isolation, but the result of the interaction between people and context. (Figure 1). (10)

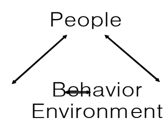

Figure 1. interactive relation

Behavior, human factors, environmental factors connected with each other and mutually decided to form a triangular interaction. From this point of view to analyze the factors which influence the audience’s information behavior to discuss three aspects including human factors, external environmental factors and the interaction between the both.

(1) The audience factors including physiological factors and psychological factors.

a, physiological factors, generally including height, gender, exercise capacity, health status, age, disease, mainly referring to people in the development and changes on the physiological functions. As the human cognitive ability, with the individual growth and progressive development, so that different age groups, often have different information behaviors.

b, psychological factors. In general, human behavior is impacted by cognitive, emotional, and emotion of three psychological processes. In these three areas, play a leading role in cognition, and mood and emotion, will, play a role in regulating the control. Therefore, the information of the acceptance of human behavior will affect the psychological factors are divided into two categories: cognitive patterns and mental state.

(2) Science Communication of the environmental factors. Different social role of a person have different information needs and impact different ways and content of information behavior. People not only have different social roles, but also have different social status, which determines the same information on the different attitudes and behavior acceptable.

The social environment factors, including three aspects: first, scientific information, which includes scientific information resource and scientific information characterization. A lot of rich information resources will consume audience energy of identification, selection and filtering and tend to audience to form mental fatigue, so it will reduce the effectiveness of science communication; and information resources are too scarce to make the audience produce disappointment and reduce the enthusiasm; reasonable representation of scientific information (such as information structure is reasonable and whether the information simple and eye-catching presentation) will affect the efficiency of using information. Second, the science communication activities. On the one hand, science communication activities as an information intermediary, provided the information source for the audience’s information behavior to promote the occurrence and development of information behavior; the other hand, the information content may be repeated processing in the process of science communication, it is different from the original source of the content, so the receiver of information have some impact. Third, technologies and tools in science communication. The use of information technology and tools to make the information behavior of the audience has undergone tremendous changes. For example, the rapid spread of the Internet today, people may not be through traditional ways and means of access to scientific information, but consciously search through the Internet to find the information they need.

(3) Interaction between the factors. We discuss the impact factors of audience’s information behavior of its own and external environmental factors. In fact, the two factors do not work in isolation, but intertwined, so this interaction also affects the audience's information behavior. For example, the mass media and audience interaction, on the one hand the mass media guide and control the audience’s information behavior, on the other hand the audience have a choice to accept the mass media impact of mass media.

Conclusion

In this paper, we carry out audience research of science communication in "information behavior" perspective, and utilize comprehensively psychology, communication, sociology and other disciplines theory in order to discuss the characteristics and classification of the audience and information behavior of the needs, processes and factors and other issues. This is the first attempt from an interdisciplinary perspective to explore the audience’s information behavior in science communication, on the basis of previous research, and focus on a number of levels from the theory of exploration and analysis. Audience's information behavior of Science Communication is based on traditional information behavior research, so the basic theory of traditional information behavior still apply in science communication. However, with environment change, science and technology development, human's information behavior is undergoing change, so the audience's information behavior of science communication has yet to be explored.

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276. S&T Culture Activities for Knowledge Based Industrial Society

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Abstract. Many countries, in the contemporary world, are putting forth their whole energy in promoting the development of science technology in an efficient way to enforce the countries' competitiveness. Among such of their efforts, one of the most significant phenomena is that their governments, universities and industries are making tremendous efforts to cultivate human resources in science technology. In Japan's case, during the second term of the Science Technology Policy, they invested heavily in four areas including biotechnology, communications, environmental engineering and nanotechnology/materials engineering, all of which have great impact in science, economy and society. Japan also celebrated four Nobel prizes laureates during the year 2000 to 2002 alone, resulting in boosting the morale of the manpower working in science & technology.

Moreover, cultivation of talented engineering manpower is one of the major tasks that the Japanese government intends to continuously pursue to achieve, and to make this happen, they are promoting establishment of the engineering education of superior quality through academic-industrial cooperation, cultivation of management of talented manpower and maintenance of various systems to recruit splendid foreign human materials.

Therefore, at the moment, it is important for us to know what we should do and how we can achieve our purposes in order for the promotion of knowledge based industry, which will be the potential power for future developments, and to establish proper policies and roadmaps so that the cooperation between the government, related authorities and manpower in the field shall be smooth.

Keywords: Education, Science and Technology culture

277. Evolution of the Public Understanding of Science in Spain in the First Decade of the 21st Century

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Abstract. In Spain, the Spanish Foundation for Science and Technology (FECYT), a body attached to the Ministry of Science and Innovation, has been carrying out a bi-annual survey on the public perception of science since 2002. The survey has been carried out in five waves (2002, 2004, 2006, 2008 and May 2010), with a steady base group of questions to guarantee comparability. The study is structured around three major blocks – interest in and information about science and technology, the social image of science and technology, and public policies to support science. Aside from serving as a thermometer to give a read-out of the level of interest in and appreciation of science and scientific activity, the study also acts to guide the Ministry of Science and Innovation in developing policies to close the gap between science and innovation and the public, identifying strengths and weaknesses, as well as target stakeholders upon, for example young people and people living in medium-sized and small towns and certain regions.

Keywords: public understanding of science, Surveys, Social perception, RTD public policies, Social image of science, indicators, Spain

278. Geophysics on Stage: bringing Earth into Scene The INGV Science Theatre Experiences

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Abstract. Since September 2008, the National Institute of Geophysics and Volcanology in Rome has started to experiment science theatre as an innovative tool to promote seismic risk awareness and earth education. Up to now two projects have been implemented within the Science Popularization and Education Lab. The first one, more traditional, involving pupils of the primary school was devoted to promote seismic risk and earthquake education among children aged 6-8. The Sicilian "Colapesce" tale was rewritten and readapted to commemorate the 100 years from 1908 Messina Earthquake, to be performed in a school theatre by pupils (II and IV classes Scuola Primaria Federico Di Donato, Rome). It was as well an experiment of science without frontiers for the presence of schoolmates from different countries (Asia, Africa, South America, East Europe and Italy). The second was a pilot-project developed in collaboration with Ente Parco dei Castelli Romani and concerning the possibility to establish in the future an Ecomuseum in one of the Lazio Region areas rich of natural landscapes and history. The students of two classrooms of the Mancinelli and Falconi Institute in Velletri (III Classical Lyceum and III Socio-Pedagogical Lyceum

), aged 16, chose an itinerary in the volcanic-origin area around the Nemi Lake to be developed in three items: the Roman Ships Museum; The lake itself; and the Diana Nemorensis Temple's ruins. The final goal was interpreting the territory with the help of scenic actions. It was a sort of opened-air theatre where history, legends and their historical figures - mainly Caligula and the Goddess Diana - described the area from the different points of view: geological, historical, naturalistic and even gastronomic. Both the projects have been evaluated, but in the second case, one of the two classrooms, being a Socio-Pedagogical Lyceum, was involved in the evaluation process under the supervision of INGV Didactic Lab. Results from both projects, and a comparison between the two will be shown.

279. The Uses of Drama as a Teaching Strategy

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Abstract. In the UK there has been a fundamental change of government policy towards teaching fact-based subjects, with a new impulse to free up the curriculum for more imaginative and cross-curriculum teaching–allowing 20% of teaching time to be at the discretion of the individual teacher.

The recent Government minister responsible for Education, Professor Hepple, has illustrated how this might be interpreted for science, through the subject of Climate in Crisis and the issue of sustainable growth, as this clearly connects with other subjects, such as Geography, History, Physics, Economics, Ecology and current affairs.

In this way, he believes that, at both school level and across all ages, the teaching of science should become:

- more appealing and interesting;
- more relevant to students' lives, connecting with the wider curriculum;
- more involving, participatory
- and more playful.

The following would, therefore, form the basis of my 20 minute paper to plenary and/or a one hour Workshop.

By taking key controversies behind the objective facts, for example (a) the benefits of the use of nuclear power for the generation of electricity versus the risks or (b) the issue of Designer Babies and the possibility of parents choosing the sex and characteristics for their children, I would explore a variety of approaches that could be applied to a range of students and abilities across the learning spectrum.

Furthermore, I would outline and exemplify a number of drama techniques that could be exploited as transferable teaching and learning strategies for a whole range of subjects within Science. These would include:

- Roleplay–by taking a historical or significant contemporary figure in the scientific sphere, demonstrating that this does not involve 'acting' skills on the part of the trainer so much as the representation of the arguments and points-of-view of this figure.
- Hot-seating–this is an extension of role-play, this is also a skill that can be exercised by the students as well as the trainer within the context of the learning situation.
- Simulation–this involves the structuring of a more concerted project, for example for a whole year group over an extended period. This could entail more detailed engagement and research across the curriculum (eg. graphics and displays, History, and Geography etc.).

Please Note: As the workshop would engage the participants practically, and I would be illustrating the techniques employed, I suggest a maximum number of 25 for this session. Plus delegates would be provided with a simple hard-copy of information and a summary of the techniques used within the workshop.

280. Talking Science and Listening: Science Communication Training for Dialogue and Debate

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Discussants:
Toss Gascoigne (Econnect, Australia)
Kajsa-Stina Magnusson (ESConet, University College London)
Jenni Metcalfe (Econnect, Australia)
Declan Fahy (ESConet, American University, Washington D.C.)

Abstract. Demands on researchers to engage with their fellow citizens about their research, its importance and its implications, have never been greater. Yet still the majority of scientists get little, if any, training for these duties in the course of their professional education and development.

Over the past two years, the European Science Communication network (ESConet) has been engaged by the European Commission to train its network-funded researchers in science communication. Over the past few years, ESConet has developed a set of training modules that be used to deliver basic science communication workshops that involve writing press releases, being interviewed, and producing public science websites. In its advanced workshops, participants get to present to policy-makers, communicate about risk, and be part of public dialogue and engagement meetings. All of these modules are supported by sessions that introduce an idea of how the mass media cover scientific research, and the importance of social science for science communication, amongst other issues. The workshops have been underpinned by a commitment to dialogue-based approaches to science communication, drawing on the latest public engagement research–often carried out by network members–to continually link theory and practice.

Given the numbers of researchers throughout Europe, demand for such workshops is high to overwhelming. Over the past two years, in an almost production-line fashion, ESConet has delivered more than training 350 sessions in three-day workshops to some 250 of Europe's top researchers. This year alone, 150 would-be participants had to be turned down due to lack of places. Many participants made it clear that other members of their research networks wanted to be trained.

A similar need in Australia is filled by private companies operating on a commercial basis. The cost has not deterred research organisations and universities commissioning workshops, and in the past 18 years Econnect (through Jenni Metcalfe and Toss Gascoigne) has run about 800 workshops throughout Australia. The model they developed has proved to be transferable: to other presenters and to other countries.

Under a new science communication package to be instituted by the national Government, new ways of training scientists are planned. These could include on-line training modules.

This session will outline the experiences of trainers delivering these workshops and reflect on the feedback from trainees. The discussion will be an opportunity for those who have staged workshops in different cultural contexts to share their experiences.

281. Preparing Citizen Scientists: Engaging Through Interactive Media

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Abstract. Use of interactive multi-media is underdeveloped in science among university science students, our future citizen scientists. They will need to produce, evaluate, and critically examine science communication in various modes of interactive media: podcasts, blogs, video, social networking, and internet platforms. We invite conference delegates to discuss how one can teach future scientists to create and interact with others via such "new media". Our session explores the new skills and insights necessary for scientists who will use these media to engage with scientists and nonscientists as well as the training and research that the field of science communication can offer.

Keywords: Interactive media, Blog, Video, Podcast

Introduction

Despite the truism that the internet is now integrated with modern life in many parts of the globe, there is substantial evidence suggesting that its potential for engagement is underdeveloped. Even among ardent users, such as university students, the interactive features of media remain underexplored. In the sciences at universities, future researchers as well as tomorrow's scientifically literate citizens express an interest in using interactive media (blogs, podcasts, digital video, social networking) to communicate about science, but they are often unsure how to go about it.

Curricula in science communication and in STEM (science, technology, engineering, and mathematics) disciplines have not as yet embraced interactive technology as a topic of teaching, training, or assessment.

We have undertaken a project to explore examples of the use of interactive media to engage students in learning and critical assessment of science and technology. The aim is to produce teaching materials, train lecturers, and evaluate the impact of our materials on student learning. We also seek to develop their ability to critically examine science communication via podcasts, blogs, digital video, social networking, and internet platforms for publishing.

Examples of Science in Interactive Media

The world of science increasingly demands professionals who can represent themselves, their organization, or their cause not only in person and on paper but online. These new technologies provide opportunities for reaching broad audiences, with the added facility for interactivity. One can potentially stimulate dialogue involving scientists, science communicators, and stakeholders ranging from villagers to highly placed government officials.

Scientists are increasingly sharing via blogs and open, electronic, laboratory notebooks. Laboratories post podcasts or enter competitions to see who has the best website or most engaging animation of a scientific process. Doctoral students place videos on You Tube that depict interpretive dances that present their dissertation topics.

Teenagers can follow the Twitter feed of a famous inventor or science fans watch the video of a TED lecture by an accomplished researcher. Citizens can contribute to debate on climate change but can also provide data. They can use their mobile phones to create videotapes depicting instances of environmental pollution or illegal logging. Smart phone apps can register sightings of animals from endangered species. Strategies for prompting action by local government can be shared on blogs and wikis, alerting “fellow travelers” via feeds on Twitter and RSS.

Opportunities for use of such media are easy to conjure, but some sense needs to be made of where things are likely to go and what role science communicators can play in these developments.

How Does One Engage Our Future Citizen Scientists With Interactive Media?

How have university students been contributing to scientific understanding through use of such media? Who are their audiences -- local residents, students elsewhere in the world? How successful have these exercises been? We will share insights from a small group of university science lecturers in Australia who assign their students to create interactive media.

What New and Old Skills are Necessary for Engagement Through Interactive Media?

Determining the aims of a communication effort, analysing the audience, developing suitable strategies, and assessing impact are all familiar undertakings for a science communicator. However, each of these processes changes when one ventures into interactive media.

Some audience segments use these media, and others are left out. As a result, strategies for communicating should accommodate.

The fact that the media are interactive can ease the process of assessing one’s impact, but it can also become more difficult because measures are changing. For example, distribution of 10,000 fliers may be considered less successful than having 10,000 web visitors who remain for 30 seconds or longer, even if only 250 leave comments.

We must reconsider how we teach students to present science, assess the impact of their messages, and respond to replies.

What Training and Research on Use of These Interactive Media Can the Field of Science Communication Offer?

How many of us provide training in use of interactive media–from workshops on creating a web page to guidelines on blogging of science or courses in how to make videos with one’s digital camera? Every science communication degree program in our country has its students learn how to create interactive media. How extensive is this training across institutions elsewhere, and to what extent is it reaching into core science curricula? How is training supported by research on the impact of online communication and dialogue strategies?

As our field is ripe for addressing how future scientists might effectively engage with others through new media, notes on what is said in our session–and ongoing dialogue–will be shared online after the conference at http:// newmediaforscience-research.wikispaces.com.

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282. Science Communication through Science Fiction: Opportunities, Challenges and Perils

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Communication without frontiers–the theme of this meet–be it science or any other area of human endeavor, is an appealing and engaging idea. While science fiction (SF) is mainly about going beyond frontiers, is about the spaces unexplored, science communication is about communicating concepts from science as we know it today. Science communication has to be about hard facts, proven concepts and theories. In the Indian context, science communication is mainly about making science and a scientific culture penetrate the socio-culturally diverse society with a view to transform it into a nation of scientifically aware people.

We need to understand that good SF is exploratory, futuristic and extrapolative in nature; it is a rich medium that discusses technological innovations, possibilities and perils; it holds all the potential for engaging and inspiring young minds; its 'thought experiments' trigger a young mind to think beyond the immediate; and above all, its interdisciplinary nature lends it the potential to be used as a tool in teaching different subjects. All these mean that science fiction is not mainly about science communication.

While SF provides the largest and the most flexible space for debates on alternate histories and futures, does it really give us a space to talk about scientific innovations as they exist today? Are we getting into the danger of mixing up science with something fictional and imaginative? What possibilities, opportunities, challenges exist when we take science communication and science fiction in the same breath? The proposed paper addresses these questions. It attempts to come up with a few guidelines to follow while using SF as a tool for science communication.

283. The Translation of Scientific Concepts Related to Climate Change in the Spanish Press

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Abstract. Considering science as a "codified form of knowledge" leads to the need of translating scientific concepts, so that they can be understood by the public. But communicating science in the media is not an easy task, as it involves several processes of interaction between journalistic values and science, which can result in a lack of the expected rigour in the presentation of scientific concepts. Previous research shows that news stories on climate change often fail to explain science in a rigorous meaningful way. For example, in many cases, they do not include the necessary contextual information nor the causes and consequences of this phenomenon. But research has not explained so far if stories explain concepts by including definition of terms and the relationships among scientific facts, in view of their interaction with journalistic values. This presentation focuses on some preliminary results of a project conducted by a group of researchers of the University of Navarra, on the coverage of climate change in the Spanish media. More specifically, it studies how scientific concepts related to climate change are explained in the two leading Spanish daily newspapers (El País and El Mundo), during the Copenhagen summit, in December 2009.

284. Science Communication Through Entertainment Media (In the Context of Science Fictional Films, Documentaries & TV Shows)

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Abstract. During the past several decades, science and media both changes time to time. From past till now science has become more bureaucratic, problem-based, and dependent on private funding. Media also change their coverage importance. In present only entertainment media continuously work on science based issue. In fact in last 2-3 years film industry more focused in science & fictions in comparison of other type of media.

Most costly James Cameron's film (1200 crore) AVATAR, Bollywood most costly (190 crore) S. Shankar's film ROBOT & one of the successful film 3 idiots are live example of the importance of science in entertainment media. All the directors & actors of these films also accept that entertainment media is the power full tool to communicate & explain science in easier way. Rajnikant (lead hero of ROBOT) also said that entertainment media has more potential to teach Hands On Science.

In foreign countries also entertainment is the best option to communicate science in mass. In maximum places colleges & educational institutions offered "Science and Entertainment Media" courses. It explores the structure, meanings, and implications of science communication through entertainment media by reading scholarly research and critically analysing media texts.

Hypothesis

Entertainment media (Specially film industry) are more aware to communicate science as a knowledge based entertainment. Changes in science communication are needed to better engage the public on science-related issues. In present the development of science calls for more discussion between all type of media & viewers-readers. It also exerts pressure on film makers and media houses to provide proper space for science journalism.

Methodology

Interview with stake holders of media and film makers. Content analysis of available reports & science based films.

285. Can Science Education be Made a Joy? The Answer is Scientoonics

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Science education is facing now-a-days a tough challenge around the world. Many times, the way it is being taught, it looks very technical, less interesting and sometimes even boring. Educationists around the world including in USA are worried as students are opting for more lucrative career options in business, commerce and information technology. This trend is not a healthy one as no country can progress without the development in science. Similarly scientific presentations in the conferences/ seminars/ workshops many times are quite boring because of the poor presentation.

Scientoonics is new branch of science, which deals with effective science communication using a novel class of science cartoons called scientoons. Scientoons are a new class of science cartoons, based on science. They not only make you smile and laugh but also provide information about new researches, subjects and concepts in a simple, understandable and interesting way. It is well said that a picture is worth thousand words. Cartoons are the combination of caricature and satire. Caricature means distorted drawing and satire means a humorous comment. If the subject of the cartoon is science then they are called science cartoons. Scientoons have been recognized/appreciated all over the world by several international organizations including WHO, UNESCO, UNEP, Royal Swedish Academy, International Union of Pure and Applied Chemistry, American Chemical Society, Junior Chamber International (USA), DECHEMA, Germany, European Science Festival 2008 and also by NCSTC (DST, Govt. of India), CSIR, Indian Science Congress Association and many more.

This Scientoon based audiovisual technique is more useful when a scientific program is undertaken for mass awareness on the subjects like environmental pollution, biodiversity conservation, Nanotechnology, DNA Technology and Human Genome, AIDS awareness and many other subjects and areas. This paper is an attempt to show that how complex subjects of science can be presented and effectively explained using scientoons so that the science communication/education can be made more informative, effective, interesting and useful. A live demonstration will also be give as how to learn to draw the scientoons.

286. Science comics in India as a pedagogical medium: A foresight

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Abstract. Contemporary science comics in India seem to be underdeveloped and rarely cater to the changing view of science-as-a-career by the Indian urbanites. The colonial tradition of newspaper cartoons in attacking science has not been carried forth and is tainted by the disconnect of an Indian Renaissance.

Towards cultivating a cartoonist's perspective to making science comics achieve a cult following, a persuasive call to investigate hidden science in folk comics and international syndicated cartoon strips is made.

While political actors find a niche backing or thrashing in comics, scientists rarely have a share in the ideology of the daily funnies and stereotypes abound unfairly and decry a no-say in their internationally marketed image.

Keywords: Contemporary science comics, Folk science in comics, Renaissance of Indian science

Introduction

Comics can help in promoting science literacy and encourage scientific dialogues. As a mass medium it supplements other modes of dissemination and engages the public in a unique way. As a pedagogical tool, comics can not only pass scientific facts, but also inculcate the mode of scientific thinking through a sustained rational narrative. Comics have been widely used internationally to discuss issues regarding scientific ethics and provide psychological support to ill patients by acting as counselors. Science comics have become a prominent genre crossing national boundaries. Translations of comics made in other countries are to be undertaken to be open to contrasting global views on scientific perspective and policy making.

Interest in comics as a two way dialogue can be enhanced through forums on the Internet, where children can speak out for their favorite characters. Comics can easily provide visibility to behind-the-scenes of publicly used scientific products like weather forecasts, dispelling myths and stereotypes that ail the scientific community. Comics can also lead to generation of strange ideas via its low profile and easily accessible take on scientific humor

In India, specifically, great science comics are rare and hard to come by. Indigenously created science comics like Scientoons and Young Scientists magazine are limited in their scope for exposition. A comics culture that appeals to the youth of India, that draws them to a reciprocating career in science is found wanting. Comics can promote the various careers on hold in science or can look at the history of the institutions of science that came about in India as different from those around the world.

In the traditional knowledge economy, beyond the usual research, development and individualized innovation model, communication is the recent catalyst introduced in the last decade that enables science to mix well in a solvent society. Beyond respecting our rich heritage, resources, wildlife and diversity and defending our country patriotically through serving the nation and promoting harmony that transcends religion, language, geography and gender, it is the fundamental duty of every Indian citizen to develop the scientific temper, humanism and the spirit of inquiry and reform (as said in Article 51(A) of the Indian Constitution). I thereby wish to herald comics as a melting pot where interdisciplinarity can be explored with a comic license, focusing on reducing the gap between the two cultures, converging science and humanity.

Science comics–What are they?

Science comics are usually an intersection of science fiction and sequential art. Sequential art differs from a movie or video in the way that static frames are spread out spatially. Similar to how movies have become ubiquitously 3-D, recent futuristic comics in the digital medium try to ensnare this effect via frames drawn with parallax kept in mind. New media constantly rediscovers and refines what is paradigmatic as a comic.

Science comics can be broadly defined as any comic that has scientific content (Fig 1 and 2.). A survey of recent science comics of repute has been underwritten by Tatalovic in [6,7]. Additionally of interest in the realm of science is the science of comics, especially where the world of 2-dimensional visuals with explicit gutter as planned by the graphiateur switches over to the 3D world of minutiae as portrayed through animation. The anticipation of motion is implicit in the framing of the scene using la ligne contour and la ligne expression. Our ability to understand and synthesise this gestural dynamism is a profound area of investigation in visual sciences.

Additionally the biological affect of comics also plays in what makes a comic character endearing. Stephen Jay Gould, the evolutionary biologist, charted the neoteny in the evolution of the Mickey Mouse sketches as the most recent redrawings encapsulate the protruding forehead and retracting jaw of the infantile and inculpable. Hence science in comics can extrapolate very far.

Figure 1. A plausible science comic from syndicated cartoon strip 'Pardon my Planet'

3. Digging the historical archives for science cartoons

Historically, during the industrial revolution, comics and caricatures seemed to be of great importance in the debate on scientific facts and their interpretation in geology and evolution with the poster boy of this era being the derogatory, but scientifically true, caricature of Darwin as an ascent from primordial life. [2, 3, 5]. 'Evolution: A journal of Nature was prominent for airing teachers' troubles in curricularising evolution while weathering creationist pressures through cartoons (Fig 3a. and 3b.)

Comics as opposed to other cultural artefacts escaped from a sustained exhibitionary culture, and have been dominated by the motion picture industry in India. While the National Council of Science Museums has a very successful network of institutions and galleries that popularise science to the public, it seems there is no programme under the aegis of NCSM to specifically promote the visual culture of science in India and science comics in particular. In recent times the institutionalisation of this movement of preserving the comic culture has been spearheaded by Indian Institute of Cartoonists at Bangalore. Even in major mobile science exhibitons on wheels like the Science Express, there has been a grave neglect of this art form.

Figure 2. Captioned - "Dashed long way to come, but at least we can have a Test Match up here without it being ruined by their wretched Earth weather." – A cartoon by Joseph Lee from British Cartoon Archive.

Rarely, plausible scientific explanations of myths from the Indian epics like the Mahabharatha find a huge audience [5]. Even the superhero culture of heroes like Superman are constantly scrutinized for scientific standing. China in comparision to India has a very robust science fiction industry and the lack of Indian science fiction attributes towards a poor representation in scientific visual editorials.

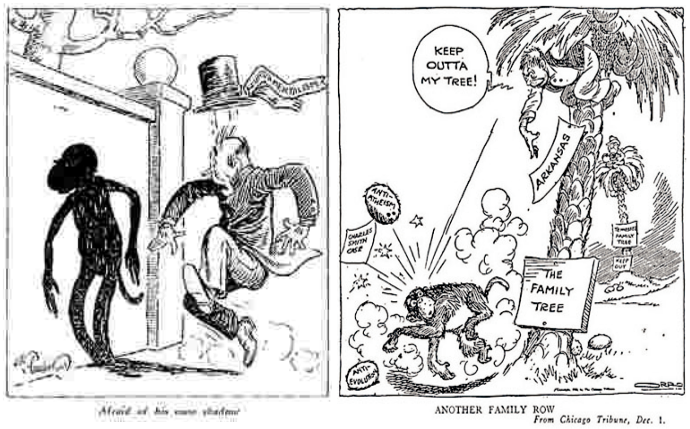

Figure 3a and 3b. Comics that fuelled the scientific and religious climate during the famous Scopes trial of 1925.

Investigating the Role of a Scientist Through Comics

Due to an increasing number of natural epidemics and catastrophies and a medialogical turn towards accountability of intellectualism the scientist is harboured with as much responsibility as a politician when the standard of life is threatened at national scales. The stereotypes portrayed in the media of the rarely represented scientist is often misleading and magnanimously uncritical. In an era of post academic science when innovation through rationality and design is a commodity, the corporate enterprise of science is defiant to mediation. Often the idea of a lay scientist seems to camouflage itself to the utopian Mertonian norms (CUDOS - 'communism','universality', 'disinterestedness', and 'organised scepticism'), whereas in spite of a marked movement to open source and open access, industrialised science follows the Zimanian norms (PLACE - 'proprietary', 'local', 'authority', 'commissioned', and 'expert')

The famous cartoon strip 'Dilbert' was famous for addressing the cynicism about organization and management and the mentality to flee from organizationally based careers [4]. As the constitution of a scientific aspiration changes the current day scientists need a comic scaffold to alert them about the nature of scientific endeavour. Famous international rivalries among scientists are staunch fodder for comic artists and it is the duty of cartoonists to deride the spectres of plagiarism and other co-morbidities that spell death to a scientific rationale.

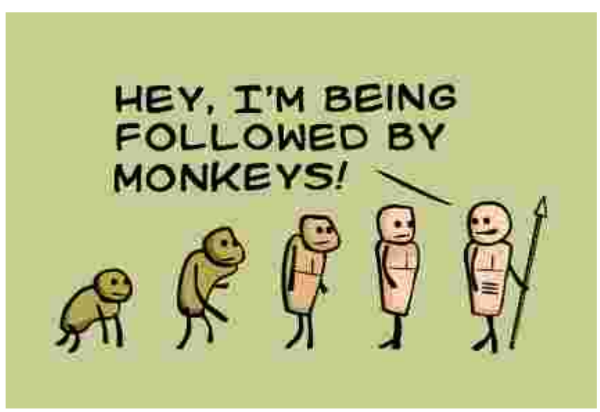

Figure 4. A simple comic representing evolution. Note the evolution of the faculty of speech and the ability for abstraction.

Visual Culture of Science in India

The talk about visual culture is often decommissioned by scientists who hold a shoot-at-sight complacency towards their postmodernist peers of other careers. However this visual culture needs to be first created and then curated nevertheless.

Through comics one could wish to rhetoricise the approach of science towards the discourse of the curator. What do scientists preserve? Can they afford to neglect a 'law' of Nature as opposed to an artist's framing of reality in a medium? Without putting in a sampling of imperfect scientific apparatus and the apparatus of imperfect science as a doorstopper, I fear the halls of visual culture would be alienated from the invisible allegations of scientific materiality and imperialism. Would scientists professionally inspire archiving the frailties and frivolities of their discourse. How do scientists immunise the veneration of the random and the ugly. While the artists embowel themselves on the sceptre of perception and illusion, the scientist corrupts nervous gimmicks around the gaze of brain teasers. In the aggressive panopticism of frontier science, hoaxes and misconducts are relayed into a paradigmatic half life. However there are not luminary vigilantes who sniff out and confront a trafficking of artistic misconduct, and nor are wars waged to neutralise weapons of drunken mass deconstruction. What, as a curatorial embellishment would a scientist tattoo on the rational animalistic hide he/she has slipped into? Comics lies at the interface of the science / art two culture debate and it hence assumes an imperial role in negotiating crossfire.

In the fall of heroism following the post-modernist's relativizing of truth and hence dismissal of an anchor to standards that guide humanistic choices, comics can cater to opinions of lifestyle abandoning the typical superhero and questioning of authority [Fig 5, 6 and 7].

While I wish to portend an immediacy of science comics in India, let me not forget that there is a huge vacuum of allied visual cultures in other societal disciplines like law for instance. While several campaigns for grassroot comics have sprouted in various communities it is of essence that academics take to the jeu d'esprit of comic denotation and hence forward an indigenous Indian directive towards the melting pot if international comics. The temperament of the comic is as much of a brand that serves as a geographical indicator of the territorial fame and hence only stands to accrue economic remuneration.

Figure 5. An attempt at humor in optometry

Figure 6. An awareness comic on obesity from 'Pardon my Planet'

Figure 7. An example of scientific rhetoric via a comic.

Acknowledgements

I acknowledge several syndicate cartoonists and graphic artists who have provided a lot of free graphic content on the web. I reproduce their cartoons here under a creative commons license.

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287. Effectiveness of Animated Science Cartoon Among Lay Audience and Educated People–A Case Study

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Abstract. Objectives of science communication are popularization of science for the developing countries like India and stimulation of scientific temper among people .We can spread awareness among people about scientific aspects of events, happenings, and natural phenomena and about scientific principles around us in daily life. Animated science cartoons are new arrival and more attractive and impressive nowadays. Science related issues can be easily communicated to the people in the form of animated science cartoons. It is an entertainment to the people without making them aware of the fact that they are under the trail of science communication. Animated science cartoon is a wonderful tool for explaining and high lighting various Scientific, Environmental concepts and Problems among all levels of people. This form of science communication, explains complex science subjects in easily understandable way because it is novel and enjoyable one. Visual images communicate more readily to the people than other media. Animated science cartoons carries information about new research, subject or data message or concept in a simple lucid and comprehensible manner to the lay audience. It attracts your attention towards a problem in a thought provoking and interesting way.

If TV cartoon are shown with science message, children will surely learn development in science and technology with more interest. Animated e- book can also be prepared with text, audio, video and animated movies. If the dry text books are converted into animated e-book and the concepts are explained through the animated cartoon characters such as Boojho and Paheli, Vikramaditan and Vedalam, Tom and Jerry, Paramathaguru and his disciples, etc., the children will certainly learn with more interest. Even knowledge on social issues like health and hygienie, environmental issues, etc. can be imparted to the common man through animated science cartoons with the popular characters among the people.

Methodology to develop animated science cartoon is to identify the science and technological issues which are directly related to the targeted audience and the animated science cartoons are developed in regional language. Animated science cartoons which are in the form of CD are portable, take up less space. It can be distributed anywhere. It is an interactive form and contains text, pictures, audio, video and animations which enhance the message that the science communicator is trying to convey. The main features are readability, usability, availability, portability, changeability and multimedia capability. It can be easily modified and updated.

List of animations taken for the case study are

1. Evil effect of smoking–It creates awareness among the people that smoking is injurious to health and create cancer problem. Feedback is received from the college students, youths and common man
2. Cleanliness and hygiene through Paramathaguru–Feedback received from school children, women's self help groups, paramedical students and B. Ed students
3. Global warming issues–Feedback received from Engineering College students.
4. Advancements in Science and Technology through Vikramaditan and Vedalam character–Feedback received from Engineering college students and common man
5. Natural calamities–An over view–feedback received from Common man
6. Thirukkural and science–Feedback received from school children and Arts College students.

Conclusion

Animated Science cartoon movies are thus an extremely popular visual medium that use an artistically simplistic style to communicate deep seated cultural assumptions and scientific thoughts and therefore Animated cartoons of science are an ideal source for analyzing popular image of science. Animated science cartoon is thus one form of science communication sandwiched between the slices of entertainment can rightly harvest people's attention. This approach is more accessible to less educated people, youth and Children. This would spread right down to the village level too. Animated science cartoon has the potential to serve both ends, a science communicators as well as common man almost with equal weightage.

288. Cartoon as a Tool for Science Communication

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Abstract. Scientific experiments are carried out to gain better knowledge and understanding in that particular field. The efforts of such scientific inquiry need to be disseminated to the common man to use this knowledge for better and safe living. It is only then that the common man is benefited. There are different ways to achieve this. Scientific communication needs to be made simple and attractive. Cartoons are one such tool that can be used in attracting and retaining human attention on matters of scientific importance. Cartoons are a universal medium; hence the task of translating science into local languages is made easy. Cartoons are self explanatory and the barriers of language and illiteracy are taken care of. Cartoons educate and entertain at the same time. They are very effective tools of 'edutainment'. It helps in creating awareness leading to discussion, debate and implementation.

'Sciencetoons' are cartoons based on science. They provide information about new researches and concepts in an interesting and effective manner with scientific principles.

Today people prefer instant messages and cartoons are powerful and effective instant tools for science communication. Cartoons convey messages with wit and humour making the topic interesting and thought provoking. This would further instigate a scientific temperament leading to scientific inquisition.

Climate change is a major concern of humanity today. Cartoons can be used to senstise this matter of grave concern.

Figure 1: Look at the excitement of the shark as it reads about the sea-level rise in the newspaper! It is sharing it's excitement to another shark to be able to swim near to the island and eat up the man who is fishing. This cartoon brings out the dangers of sea level rise.

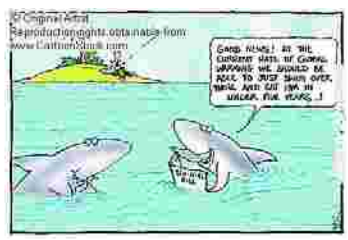

Figure 1

The sea level rise is not merely due the melting of polar ice and glaciers adding extra water to the seas. It is also because the sea water is expanding as it heats up. This could mean total disaster for many islands and coastal areas, especially river delta areas. Sea level rise is a phenomenon that has occurred due to climate change.

Figure 2: Local stories inspired this cartoon yet it's a problem everywhere. The lack of available land to build houses on compels people to build homes on flood plains... which, of course, occasionally flood. Invariably, the lawsuits start flying.

Figure 2

All these cartoons highlight the apprehension both at the universal and local level and hence can direct towards enhancing scientific temperament. This paper examines the use of cartoons in creating awareness and disseminating scientific information for a better and healthier tomorrow by undertaking a discourse analysis of cartoons published in newspapers as well as those posted on the internet.

289. A National Policy on Science Popularization of Tremendous Weight

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Abstract. There are many ways of the study on policies in terms of science and technology. Some argue the importance of policies, some point to the process of policy making and the lack of reason in bringing out sound policies, and still some make brief introductions to the available ones (most of the time they lay there for the 'snookers' to approach by themselves). Many countries have produced kinds of policies in the field of science communication but it is rarely seen up till now detailed analyses of them that may help people beyond the boundaries to well understand what they are, which is absolutely an inconvenience for the colleagues in the circle to get understood each other. Policies are decisions of decision makers. They are important because they represent the will and intention of the power, they try to secure the course of the enterprise in their countries with sort of carrot and stick, and once they are put into effect they might change that part of the world. For these reasons, the paper tends to try lifting the veil to look into this piece of appealing domain, by introducing, also briefly, to the Outline of the National Scheme for Scientific Literacy, a very important national policy on the state level now governing the practices in the field of science communication in China. This short presentation will be divided into three parts: (1) The background and the formulation of the policy. There are also two peeping pipes to look into the issue. For background part, we can see the need to produce such a policy is both of domestic pull and exterior push. The policy was enacted in 2006. It was a time when China was running fast in managing its economic and social progress. High quality citizens are needed. Beside that, the idea of produce such an ambitious scheme was also encouraged by the USA 2061 project and some else. For formulation part, the process of producing the policy was carefully designed starting with small group studies of a dozen of focused topics bonded in a package. Rounds of rounds consultative discussions and seminars were organized. The working pattern reflects the influence of the current global practice. (2) The structure of the policy. Goals are set in phases. The guiding principle is clear while demonstrating Chinese value and understanding of the thing that is called science popularization, or science communication, whatever. Target citizens are divided into four groups: farmers, working population in urban areas, youngsters as well as leaders and public servants. In securing the effect, four projects are fixed up in priority. (3) The effect of the policy. Four years have passed since the announcement of the Scheme. Efforts invested began to yield fruits. Science-based governmental organizations are requested to engage themselves in coordination, social sectors are mobilized, scholars are encouraged and social resources are integrated in various forms. China never sees an action in such a magnificent scale. Yet there are still some areas are left in the dark. Measures will be taken in the next five year plan.

Keywords: national policy, science popularization

290. 2009–The International Year of Astronomy: How Did It Go And What Did We Learn?

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List of invited speakers

- Ranjeev Misra, Inter-University Centre for Astronomy and Astrophysics
- Kevin Govender, South African Astronomical Observatory/Developing Astronomy Globally
- Kimberly Kowal Arcand and Megan Watzke, CfA, Harvard/From Earth to the Universe

Abstract. In 1609, Galileo turned his telescope–then recently invented–towards the sky above him. What he saw amazed him and led him openly to question the then-prevailing teachings that the Earth was at the centre of the universe and that, above the near-Earth environment, the heavens were pure and unchanging. Moreover, Galileo's observations and his interpretations of them opened up every received dogma about the natural world to critique based on personal measurements and personal reason. To mark the 400th anniversary of that system-shattering event, the International Astronomical Union organised the 2009 International Year of Astronomy (IYA2009) under the theme "The Universe, Yours to Discover".

Many spectacular initiatives took place during 2009 and early 2010, from the twelve global Cornerstone projects to the thousands of national activities where millions of people got involved in astronomy-themed events. Citizens previously unaware of astronomy became involved in this most democratic of sciences in vast numbers. Activities ranged from star parties to street parades, touching old and young alike. Take, for example, the two worldwide star parties "100 Hours of Astronomy" and the "Galilean Nights" where more than 3 million people got involved with many citizens seeing night sky objects through a telescope for the very first time; the Indian astronomers proudly showcasing their work at the Republic Day parade in Delhi, where around 30.000 people participated; or the Guinness World Record 4.8 km-long canvas painted during the astronomy-themed Oceans Festival with more than 300,000 participants in Portugal.

But how was the celebration of an essentially western, essentially European, "scientific revolution" received across the globe, with its various social and cultural environments? Making use of the experiences of European, Indian, Brazilian, Korean, Japanese, etc experiences, this session will look critically at the experience of IYA2009. It will describe some of the events that occurred, their reception and what astronomers and science communicators have learned from their experiences.

291. (Scientists in Popular Culture: Between Stereotypes and Celebrities)

Science Communication Through Mass Media

Presenters

Massimiano Bucchi, University of Trento, Italy
Richard Holliman, Open University, U.K.
Declan Fahy, American University, United States

Overview. This seminar presents the findings of original research projects that have explored some of the diverse and complex ways in which scientists have been portrayed in contemporary popular culture. The papers offer unique, but complementary, analyses of scientists' fictional and non-fictional representations in a variety of different mass media formats, genres and cultural contexts. The seminar examines how images of scientists are disseminated, described, constructed and contested, not only in journalism, but in other cultural forms, including animated cartoons and popular science books, through which audiences encounter and engage with scientists and scientific ideas.

In their work, the presenters have used diverse methodological approaches and theoretical frameworks. Massimiano Bucchi explores, through mass media coverage of Nobel laureates, two contemporary trends in the communication of scientific information: the proliferation of journals disseminating results, on the one hand, and the concentrated attention given in particular journals to a limited amount of eminent scientists, on the other. Richard Holliman presents work that he and colleagues have undertaken to examine images of scientists in animated cartoons shown on children's television, finding that these forms retain at least some of the stereotypical imagery that was evident in the 1950s. Declan Fahy explores ideas about scientific fame through an analysis of three contemporary British scientist-authors, recontextualising their popular representations using approaches from emerging theories of celebrity.

The seminar aims, through presentations and discussion, to draw comparisons and contrasts between scientists' portrayals in these different cultural forms. It aims also to provide original insights into the contemporary representation of scientists in popular culture to a range of audiences.

Keywords: Scientists, Mass media, Representation, Popular culture, Television, Nobel laureates, Animated cartoons, Celebrity

Paper 1

292. Imagining Scientists: Exploring Stereotypical Representations of Scientists in Animated Cartoons for Children

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Abstract. For more than 60 years researchers have explored stereotypical images of scientists. During this time they have attempted to isolate the small number of essential, simplified criteria that represent a scientist. This work began in the 1950s when two cultural anthropologists, Margaret Mead and Rhoda Métraux, drew on the perceptions of American high-school students to produce a composite image of a 1950s scientist, combined with a number of positive and negative characteristics. Their findings, published in the journal Science, described a stereotype that still features in some forms of popular culture.

Why does the stereotype of an aged, hirsute, bespectacled, disheveled and clumsy smale scientist endure in some forms of popular culture, and in spite of the considerable efforts to challenge and replace it with more authentic images of what 21st century scientists actually look like and do? And are alternative 'types' of scientists emerging

to challenge the 1950s stereotype? How do these emerging types differ from the stereotype identified by Mead and Métraux? Importantly for those concerned with perceptions of science in the public sphere, how do people, particularly young people, respond to images of scientists? To what extent do these images influence the self-concept ("what I perceive myself to be") and self-efficacy ("what I believe I could and would like to become") of young people in how they perceive the sciences? Do children and young people have the media literacy skills to deconstruct stereotypes and respond to them in ways that are relevant and useful to their perceptions of the sciences? We explored these questions in a project called Invisible Witnesses (open.ac.uk/invisible-witnesses).

In this paper we explore representations of scientists from UK television, focusing on animated cartoons produced for pre-school and school-age children. We document the use of symbolic codes and characteristics to represent scientists, and study how the roles attributed to scientists relate to issues of gender. The findings indicate that there are an increasing number of 'types' of scientists represented in animated cartoons on children's television, with more women scientists appearing. However, the symbolic codes attributed to the 1950s stereotype are also routinely deployed by the media professionals that produce animated cartoons. Our research also found that children and young people have sophisticated media literacy skills. They easily differentiate between fact and fiction. And they have the skills to deconstruct stereotypes and imagine themselves as scientists, even if this is not their selected career path. In conclusion, we argue that animated cartoons could represent scientists more accurately and authentically, and that children and young people, as well as scientists, could usefully contribute to the process of developing characters for these series.

Paper 2

293. Star-System and Long Tails: Contradictory or Complementary Trends in Science Communication?

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Abstract. Communication of scientific results seems today to be shaped by apparently contradictory trends. On the one hand, fuelled by the proliferation of journals and the diffusion of digital journals, the 'tail' of available contents gets longer: there is more and more space for an increasing number of contributions, however specific and targeted to small niches in terms of audiences. On the other hand, substantial recognition and visibility appear more and more concentrated within a limited circle of journals and scientists that are the equivalent of blockbusters in markets like music or cinema.

The paper will explore the connection between the above dynamics and growing proximity between scientific research and the mass media, highlighting how the 'Matthew Effect' described by Merton (1973) gets amplified under the pressure of research institutions' public relations and through increasingly frequent short-circuiting between science and communication. Thus, science becomes subject to a star-system logic which is not so different from the logic of sport or show business: scientists who have become familiar to the broader public turn into powerful 'brand' currency which can be 'spent' in a variety of situations. The case of Nobel laureates will be explored in this light.

Paper 3

294. Hawking, Dawkins and Greenfield: Case Studies of the Celebrity Scientist

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Abstract. At the end of the twentieth century, a group of British scientists emerged as high-profile researchers, authors and public intellectuals. Vogue magazine in 1997 called them the "pop scientists of the 1990s" and they were

protagonists in what The Independent called in 2001 "an age when science [was] dominated by its media superstar authors". These scientists became well-known outside their scientific fields, their marketed books becoming bestsellers, their talks packing out literary festivals, their opinions being described and dissected in mass media publications as diverse as The Times and Hello!

But what is a superstar scientist? What are its essential features? Is scientific fame different from sporting, literary or filmic fame? This paper addresses these questions, exploring the phenomena of the celebrity scientist, defining its central characteristics, explaining the process of its creation and describing its social role. It does this through an analysis of three scientists: physicist Stephen Hawking, author of A Brief History of Time (1988), the highest-selling popular science book ever published; evolutionary theorist Richard Dawkins, author of books including The Selfish Gene (1976) and The God Delusion (2007) and the UK's first Professor of the Public Understanding of Science; and neurologist Susan Greenfield, former director of the Royal Institution and author of books including The Private Life of the Brain (2001) and Tomorrow's People (2004).

The paper, using novel approaches from the emerging field of celebrity studies, argues that these three scientists are represented in mass media as celebrities. They share characteristics with famous writers, politicians, film and sports stars, characteristics including their representation as unique individuals whose public and private lives merge, their commodified image being bound up with promotion, and their persona embodying abstract values, ideas and ideologies.

The three subjects also share characteristics, this paper argues, with iconic historical scientists, including Isaac Newton, Charles Darwin, Albert Einstein, Fred Hoyle and Carl Sagan. It examines how the distinctive image of each celebrity scientist has been fashioned through a combination of the subjects' own writings and television work, their interviews and profiles, their intertextual representations in fiction and non-fiction, and a linking of their work with recurring concepts in the history of ideas. The paper argues also that the subjects have come to represent the strongly mediatised and commercialised character of contemporary science.

295. RETINA –Science Communication for Blind Students

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Abstract. Science has been reported as one of the easiest areas to promote inclusion of students with special needs. Nevertheless there is overwhelming evidence that blind or visually impaired students are frequently unsuccessful in Science related subjects. In 2010 the Outreach Science Unit from IPATIMUP started a long-term project focused on strategies to tackle this problem of Science communication, based on the use of hands-on and enquiry-based approaches.

We started a characterization of Science Education scenario for visually impaired students in Portuguese reference schools. In Portugal these Reference Schools integrate blind students in regular classes with visually able students and congregate human and material resources that can offer a better educational environment. From our preliminary observations we realize that the institutional model of the reference schools is unsuccessfully consolidated due to frequent organizational changes and lack of qualified human resources. Furthermore science curriculum is focused on the memorization of concepts and the students lack hands-on experience and enquiry-based learning. In order to evaluate the relevance of an enquiry-based model to effectively communicate science to blind students, we draw a collaborative study with the Science education research group from Reading University which aim to perform: A comparative study of science learning models for visually impaired students in Portuguese and UK schools, namely identifying: a) problems faced by the teachers, b) difficulties and limitations experienced by the students, c) examples of good practice. Based upon the data collected in this study we aim to develop a science communication program adapted for students with visual impairment. This study will bring new insights about the impact of the model (enquiry based vs non-enquiry based) in the effectiveness of Science communication for visually impaired students.

296. National Strategies for Science Communication: Comparing International Approaches

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Abstract. This paper presents four contrasting national strategies for science communication, representing Australia, China, the United Kingdom and India (the last of which is still under development). The three published strategies all involved broader consultations as well as government and high-level strategic input in their development. All the strategies focused on both public and policy-related audiences, and shared many common action points such as providing training and improving the infrastructure and sharing of resources for science communication. There were however some differences in their scope and focus, mainly arising as a result of economic, cultural and social differences between the countries.

Keywords: National strategy, China, Australia, UK, India

Introduction

As the benefits of science communication have become more apparent, governments around the world have begun to implement processes to develop far-reaching national strategies for embedding science communication into wider practice. There are often similarities in the challenges being addressed by different countries, for example decreasing interest in science within the population (especially for pursuing a scientific career) and reduced funding for scientific research. These issues are particularly apparent in the USA, the UK and parts of Europe in recent times, with reduced funding partly due to economic downturn in those regions, whilst other countries (such as China and Australia) have seen a surge in science-related R&D investment by central governments. The approaches taken by different countries therefore often differ in their scope and implementation, reflecting both national cultural differences as well as potentially different science communication ideologies.

This paper briefly compares the strategies implemented by four contrasting countries: China, Australia, the United Kingdom and India. Each national strategy is briefly introduced, followed by a comparison and analysis of the key similarities and differences between the four strategies.

China

The National Scheme of Scientific Literacy for All1 was launched in 2006, as a long-term strategic action plan to make China into an innovation-driven country. In order to realize its objectives, the State Council asks government at different levels to raise their inputs and provide policy support on: 1) science education and training, 2) scientific museums and related facilities, 3) resource-development for science communication, and 4) capacity-building of science communication by mass media. The implementation of the Scheme relies on an alliance of ministries, academies, as well as non-governmental organizations during the last five years.

Australia

The Inspiring Australia2 report proposes a national strategy for public engagement within Australia that will help realise government goals related to innovation and scientific development. The strategy encompasses a more coordinated approach to communicating the sciences across the country, and was developed through a series of national consultations with a wide range of science communicators, educators, journalists and scientists in all states and territories.

United Kingdom

Following a consultation on Science and Society, the UK Government set up the Science for All Expert Group to develop a national Action Plan3. Three challenges were identified: gaining a wider understanding of why, when and how the public engages with the sciences; developing supportive networks and mechanisms for increasing effective engagement; and encouraging a professional culture that values, recognises and supports public engagement. Many organisations are committed to deliver the plan together, working informally and with Government support.

India

The first Prime Minister of India, Pandit Jawahar Lal Nehru presented the Scientific Policy Resolution on March 4, 1958, which has been a guiding factor for development of science and technology in the country. Special attention was given to the scientific approach and communication in the resolution, which has been a basis for various policy and strategy documents since. For example in 2003 the government of India announced a comprehensive Science and Technology Policy 2003 that carried a section on 'Public Awareness of Science and Technology. However to date there is not a single defined strategy for the entire country. The NCSTC (National Council for Science & Technology Communication) is currently under way for formulation of a document.

Comparison and Analysis

Taking the four national approaches outlined above, a brief synopsis of their key elements is provided below. For ease of comparison this has been broken down into four fundamental areas: the motivations behind the development of the respective strategies (including their stated objectives); what processes were involved in their development and how far they have progressed in their delivery to date; who the priority target audiences are within each country; and finally a comparative analysis of the scope of the action points and/or recommendations contained within each strategy.

Motivations and objectives

All four countries demonstrate a consistent desire to improve both levels of recruitment ('capacity building') and the skills of those recruited to science and technology (S&T) roles. Within certain countries (e.g. Australia) there is explicit recognition that without wider acceptance of S&T amongst public groups (not just those who become scientists) this recruitment will not be possible, although this is implicitly recognised within other strategies also. The Australian and Chinese governments have both identified clear priorities relating to driving 'innovation' within their countries, which also comes into play in their science communication strategies. In addition to the 'public' oriented audiences, the Australian approach also aims to achieve improved links to policy, and an 'open relationship' between science and society. China also includes policy makers and public servants as a key focus (see 'Target Audiences' below). In the UK the orientation is further extended to recognising the potential impacts on the researchers involved in science communication – that there are benefits to science as well as society – and a key focus is to 'ensure that public perspectives are sought, recognised and responded to by the scientific and policy committees'.

One interesting area of contrast is the different definitions and language used within the respective strategies. In particular, both Australia and the UK use very broad definitions of 'science', for example in the UK this is stated as 'encompassing research and practice in the physical, biological, engineering, mathematical, health and medical, natural and social disciplines, and research in the arts and humanities'. Whilst most of the other strategies talk about 'science communication' or 'science engagement', the Chinese strategy refers explicitly to 'science popularization' - a historically preferable phrase in China referring to the prevailing cluster of concepts such as science communication, PUS (public understanding of science), scientific culture, etc. In the UK, the term 'public engagement' has largely taken over. It is seen to include ideas of science communication and public understanding but additionally covers a wider range of purposes and types of activity between scientists, policy makers and the public.

The stated objectives within each national strategy reflect strongly on cultural and social norms within the country in question. For example, in China efforts to improve scientific literacy take advantage of the lead role played by the government, aiming to 'promote a full-fledged economic, social, human development, to improve China's independent innovation capacity and overall national strength, and to create a solid workforce foundation for building a moderately prosperous society'. In the UK, where government is less central to everyday life, there is a stated intention to 'deliver a shift in cultural awareness, recognition and support for science'. The focus is on improving the cultural role of science rather than how well it is understood by public groups. In contrast, in India, where average GDP is much lower, and more basic needs come into play, the focus of the strategy currently being devised is towards the 'improved wellbeing of citizens and saving and shaping their lives'.

Development and current status

In line with existing good practice within the field, all three of the existing strategies have combined a central 'Expert Group' (UK) or high level steering committee (Australia and China) with some form of wider consultation with key stakeholders in order to ensure that the resulting strategies were relevant and useful to the people they would impact upon. In most countries there has also been recognition of the importance of research evidence.

The approach in China represents the current phase in a series of schemes to improve S&T popularization. The process of producing the policy was carefully designed, starting with small group studies of a dozen focused topics bonded in a package. Rounds of consultative discussions and seminars were then organized to produce the final version. The Scheme is designed to be completed in two phases, the first from 2006 to 2010 and the second from 2010 to 2020. Specific goals are set respectively as short-term and long-term perspectives.

In Australia the impetus was provided by a recent (2009) 25% increase in spending by the Australian Government on science. This increased focus led to recognition of the need for the development of a national communication strategy. The steering committee contained representatives from the media, Questacon (Australia's national science and technology centre), government-funded research organisations, the Office of the Chief Scientist and the relevant government department. More than 230 people were involved in the wider consultation, including science communicators, educators, journalists and scientists in all states and territories. Since the release of the Inspiring Australia report, the Australian Government has committed to implementing the strategy contained therein, and initial planning is underway for implementation including the development of a framework of principles of science communication initiatives, establishment of coordinating groups and networks and progress on campaign branding.

In the UK the strategy development took the form of a major public consultation on Science and Society by the Government, one result of which was the setting up of the aforementioned Expert Group to coordinate a coherent national approach to resolving the issues identified in the consultation as well as celebrate and disseminate recognised successes. Separate groups were set up to investigate 'Science and the Media', 'Science and Trust', 'Science and Learning' and 'Science for Careers' in addition to the 'Science for All' group which produced the Action Plan described here. Since the Action Plan was published a follow-up group has been established to further progress the identified action points, with regular public updates as the work continues.

Although not yet in a publicly accessible form, the Indian approach differs most significantly through its focus on field projects involving people on the street and grass-root level. The thrust in early post-independence India was on scientific temper and science education, formal and informal and science communication was mainly centered on publication of books and magazines, etc. The interest was triggered generally in the 60s and 70s in agriculture, space and programmes on the radio began because of the green revolution and space expeditions. The decades of the 80s and 90s witnessed a shift from indoor communication to outdoor science communication channels, such as Vigyan Jatha and use of folk media. This grass-root focus is continuing in the current developments of a national Indian strategy.

Target audiences Only the Chinese Scheme identifies explicit target audiences to date, although the intended recipients may be readily inferred from the strategies outlined within the other countries. Within China the focus is on improving the scientific literacy within the following four groups:

- Young people
- Farmers
- Working population in urban areas

- Leaders and public servants

The first group clearly links into the focus on recruitment and capacity building, and is shared amongst all four nations. ‘Farmers’ and ‘working populations in urban areas’ are more unique to the Chinese cultural situation, since there are distinct differences in scientific literacy between urban and rural populations which are less apparent in other countries. Farmers in particular are identified as a key group due to their potential role in ‘ecological environmental protection, water resources efficiency, cropland protection, disaster prevention and preparedness, healthy lifestyle, eliminating bad habits, and opposing foolish superstitions’. The intentions relating to improving farmers’ scientific literacy are threefold: personal improvements (such as increased yields and incomes, improved lifestyles, and skills development); better employability of labour transfer to non-agricultural sectors or cities and towns; and raised scientific and cultural literacy for women in the rural areas and for farmers in certain strategic regions of lower development and ethnic autonomy.

The final group – leaders and public servants – is recognised in all three existing strategies, and potentially reflects increasing concerns regarding the scientific literacy of policymakers more broadly. Somewhat more cynically, it may also be a reflection of the government interest in the development of all three strategies – government departments relating to science and technology will of course want their colleagues in other departments to value and respect their work. One of the five key themes within the Inspiring Australia report is ‘National Leadership’, recognising the crucial role that leaders both within and external to the science communication can play in this regard. Within the UK a specific action relates to promoting ‘successful knowledge exchange between the sciences, policy and business’. Within China the inclusion of policy leaders as an audience has already borne fruit, with more money being put into the popularization of S&T since the development of the Scheme. Industrial organisations and businesses are recognised as potentially very relevant partners however work within some countries has demonstrated that they are less visibly engaged in science communication than academia and the public and cultural sectors, focusing instead on activities which target young people directly (education, skills development and recruitment).

There is also a clear intention to improve audience diversity and widen the reach of science communication activities to less traditional audiences. In the UK the very name of the Expert Group – ‘Science for All’ – reflects this focus, and the other reports make similar mention of improving accessibility for under-represented groups within science, for example indigenous and rural communities.

Scope and focus

Each of the three published national strategies has been broken down into key areas of focus, with various action points recognised within each area. In the Chinese approach four ‘action plans’ have been identified, each relating to different aspects of improving the popularization of science and technology (PST):

- Science and education training
- Developing and sharing PST resources
- PST related infrastructures
- Capacity-building of science communication by mass media

Beneath each of these plans lies a subset of ‘missions’ and agreed targets.

By contrast, in Australia there are 15 ‘principles and recommendations’ supporting five key themes:

- National leadership
- Telling the Australian science story
- Engaging all Australians
- Building Australia’s capacity
- Mobilising Capability

In the United Kingdom there are 19 broad objectives which have been identified, with 60 specific actions or recommendations to help achieve them. The UK Action Plan is set out against three key challenges identified by the Science for All Group:

- A wider understanding of why, when and how the public engages with the sciences
- Supportive networks and mechanisms for increasing effective engagement
- A professional culture that values, recognises and supports public engagement with the sciences.

The respective plans share much in common with regards to specific recognised actions. The sharing of resources is a common theme, for example the development of an online ‘collective memory’ to share learning from evaluations of public engagement in the UK. Similarly, all three countries refer to improving infrastructures for science communication, although the focus in each case depends on the maturity and scale of the field in each country. In

China and Australia the intention is to improve and/or create an appropriate national infrastructure, whereas in the UK the initial challenge is to better map the existing infrastructures that support public engagement. This is in part related to the wider existing infrastructures in each country – in Australia for example there are Local, State or Territory and Federal governments, each with different responsibilities relating to education, training, and science support. The development of a national infrastructure therefore needs to recognise government priorities at other levels.

Training is also an area that appears in all three published plans, although the audience and focus for the training does differ. In China this refers to education and science training for their four identified target audiences, whereas in Australia the focus is on 'communication training' (especially media training) for researchers and others associated with scientific research. In the UK there is recognition of the 'field' of science communication and the need to provide appropriate professional development of scientists and the increasing group of people working as professional science communicators. Further to this, the need for reward and recognition of researchers involved in science communication is highly visible within both the UK and the Australian strategies, including developing a 'Concordat for Public Engagement' by research funders in the UK to provide clear expectations as to their responsibilities in this area. The three countries also recognise the importance of research and evaluation in science communication, emphasising the importance of building their strategies on a clear evidence base.

The mass media are an explicit focus within both the Australian and Chinese strategies, and the UK addressed this through its 'Science and Media' report and action plan. Both Australia and the UK make mention of online and social media as opportunities for development, reflecting the high uptake of the Internet as a communication medium in those countries.

The main difference in approach between the three published strategies relates to their over-arching role: within both China and Australia there is a focus on branding and public campaigning as well as providing an over-arching strategy for national action. This focus potentially relates to an increased role relating to the marketing or publicity of science and technology to the various target audiences. In contrast, within the UK the strategy focuses on the development of a culture of public engagement and a recognition that there are many different and equally valid purposes and types of engagement. Indeed, one interesting piece of work being carried out in the UK by the Science for All Follow-up Group is the development of a simple tool to make explicit the different purposes and types of public engagement, so that individuals or organisations planning activities can place their objectives and plans in a wider context. There is also a recognition of the benefits to those involved in public engagement (as well as to public groups) within the UK strategy which are not made explicit elsewhere. Neither of these approaches is necessarily better than the other, but are likely to be due to cultural and ideological differences in the respective countries.

Conclusions

The four countries represented here – China, Australia, the United Kingdom and India – represent a wide variety of cultural and social perspectives. Their national strategies therefore contain key differences in order to reflect the priorities and needs of their populations. The test of the value of the different strategies will of course be in how well they succeed in achieving their respective stated aims. China is already five years into the implementation of its Scheme, however the UK is less than a year into its implementation phase. Australia has only recently received government approval to go ahead with the proposed strategy but will be entering its implementation phase within the next six months. India's strategy is still in formal development but is built on a long-standing commitment to policy in this area. With all four nations emphasising the importance of research and evidence-based development of their strategies this is certainly an interesting time to monitor and compare different national approaches.

References

[1] The English version of the Outline of the National Scheme for Scientific Literacy is available at: http://www.kxsz.org.cn/english.html

[2] A PDF copy of the full Inspiring Australia report and strategy is available at: http://www.innovation.gov.au/ General/Corp-MC/Documents/InspiringAustraliaReport.pdf The appendices are a rich source of information additional to the key recommendation details. In particular, Appendix 7 is a very useful snapshot of relevant Australian and international reports.

[3] The Science for All Action Plan and supporting documents may be downloaded from http://interactive.bis.gov.uk/scienceandsociety/site/all/2010/02/09/science-for-all-report-and-supporting-documents/

297. (Symposium: Engaging People in Climate Change Science)

A Critical Review of Science Communication in the World

Chair: Toss Gascoigne

Speakers:

1. Farmers drive their own climate change science communication–Jenni Metcalfe, Australia
2. Involving experts and citizens on Climate Change Debate–Giuseppe Pellegrini, Italy
3. Climate Change – a reality or myth? Communications that count–Jose George Pottakkal, India
4. Changing the climate through art and science communication–Janet Salisbury and Glenda Cloughey, Australia

298. Farmers Drive Their Own Climate Change Communication

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Abstract. This paper will present about a program involving 34 farmers across Australia who are being supported and trained to communicate with their peers about climate change science and actions for mitigating and adapting to climate change. It will report on the research behind developing this program, the activities of the program and the ongoing evaluation of the program.

The paper will also explore ‘best practice’ guidelines for engaging the public, media, governments and business in climate change, as developed through three ‘Hot Air’ symposia organized by the author in collaboration with the Australian Science Communicators.

299. Involving Experts and Citizens on Climate Change Debate–The European Project Accent

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Abstract. Climate change issues are clearly a growing concern for the public today. In recent years, people have received a great deal of information from media on the causes and consequences of climate changes, but– depending on countries and regions–the understanding of citizens and their engagement in these topics is still varied. Communication professionals are making effort to communicate the messages correctly. This presentation proposes to contribute to a global effort to develop news tools and actions on climate change from “informative” to the “active” procedures through the exchange and dissemination of practices that involve citizens in actions and dialogue.

In my talk I will start taking into consideration some recent data on European public opinion. Secondly, I will introduce the Accent project (http://www.i-do-climate.eu/), an initiative promoted by a group of 12 European science centers proposing “active procedures” of involvement on the issues of climate change. The science centers are using “active procedures”: hand-on exhibitions, participative games, local citizens forums and many others, in order to engage effectively the public in such themes.

The central point in this presentation is the promotion of two-ways communication channels between the scientific community and the public. Specific attention will be given to the participation of scientists and the role of science centers in the development of communication tools and programs for the choice of scientific topics and for correct and clear information to the non-expert public.

300. Climate Change–A Reality or Myth: Communications that Count

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Abstract. Climate Change has been a topic of intense debate that polarized not only various stake holders but also the community of nations. It has become an economic and political issue although at the back of it all is the question whether globally climate is warming at a rate that can affect ecosystems and humans. This is a question that can be answered by environmental and social scientists through observations, predictive models, etc. However, as recent chain of events in the media involving scientific communications suggest that we scientists have been poor communicators to the public. While quasi and pseudo scientists had a field day in the communicating baseless information, hard-core scientists especially natural and physical scientists had been left out of the debate partially because of their being cocooned in their own world, unable to meaningfully communicate the results of their observations and research.

In my brief involvement in participating in the recent public debate on the retreat of Himalayan Glaciers, I found the thirst of general public for information. This paper will try to analyse and introspect three specific instances of my attempt at communicating what I have learnt through research each in a different setting. The first was a live debate on Lok Sabha Television (People's Forum, February 28, 2010), the second being Earth Day Celebrations at Jawaharlal Nehru University (April 22, 2010) and third an Open Forum titled, 'Copenhagen and beyond' on World Environment Day (June 5, 2010). Each of these were a learning experience to me in communicating scientific observations and inferences to various shades of laymen. While all three where opportunities for public communication, what I would call scientific reticence inhibited communication of possible in the first event. The second, which was on home ground and the audience in general where university students and faculty from other fields of study, the take was much better. The third, in Kolkotta became for me an opportunity to communicate and inspire young and not so young people to study Himalayan glaciers.

301. Changing the Climate through Art and Science Communication

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Abstract. In its apocalyptic scale and emotionally charged urgency, climate change is like no other issue in science communication. Climate scientists hold knowledge about the fate of life on earth. And those who have studied the science in detail and written books must sometimes have been overwhelmed. For example, in writing 'the future of biodiversity and civilisation hangs on our actions' (Flannery 2005, p.306), and 'there is almost no time left to act' (Lovelock 2006, p.8), these scientists are revealing the unbearable reality that underlies the unemotional graphs and statistics that are the tools of their trade.

Apart from the unacknowledged emotional burden the scientists bear for humanity, an honest emotional response to the significance of their assessments is rarely publicly discussed and hardly ever mentioned in communications from political and business circles. In relation to climate change, it is difficult to find examples of the axiom that communicators must 'talk with' rather than 'talk to' people about science, although this has been a well-accepted conclusion of the UK Government's report on Science and Society (HLSCST 2000), and the White Paper on science innovation policy for the 21st century, which stated:

'... science is too important to be left only to scientists. … When science raises profound ethical and social issues, the whole of society needs to take part in the debate.' (UK Department of Trade and Industry 2000, p.54)

The likelihood that artistic vehicles would help carry emotion and unblock the way towards emotionally mature, wise actions by policy makers has been explored in poetry, music and drama by the Canberra group A Chorus of Women in many presentations since 2007. These original presentations have drawn on the work of the Australian poet and environmentalist Judith Wright, Australian sculptor, Tom Bass the Greek playwright Aeschylus (480 BC).

This paper describes the philosophical, artistic and emotional underpinning of two of these presentations,

and provides insights from the facilitated discussions between scientists and nonscientists that have followed the performances.

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302. Translation of Scientific Concepts in the Media: A Study of Information on Climate Change in the Spanish Press

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Abstract. Considering science as a "codified form of knowledge" leads to the need of translating scientific concepts, so that they can be understood by the public. As academic research has shown, such processes of mediation are of paramount importance, since they can help to improve scientific literacy of citizens or they can impoverish it, by means of interpretations and images which are not rigorous. But communicating science in the media is not an easy task, as it involves several processes of interaction between journalistic values and science, which can result in a lack of the expected rigour in the presentation of scientific concepts.

There exist several differences between the processes involved in the production of information in the media and those of scientific work on climate change (CC). While nature processes take place in large periods of time, media work is characterized by a continuous search for the novelty, the immediate and the specific. The absence of "news values" has provoked that information on CC is not always as frequent as it should be, according to the social relevance of the topic. Furthermore, several traditional criteria used in journalistic work, such as the search for balance, have been a source of inadequate coverage of environmental issues.

Previous research shows that news stories on CC often fail to explain science in a rigorous meaningful way. For example, in many cases, they are too superficial and do not include the necessary contextual information (vg. the causes and consequences of the phenomena they portray). In addition, media tend to give priority to journalistic values and criteria over scientific rigour, which can result in stories that are not precise, from a scientific point of view. For example, media tend to translate hypothesis as certainties.

Research has not clarified so far if stories explain concepts by including definitions of terms and explaining the relationships among scientific facts, in view of their interaction with journalistic values. This paper focuses on some preliminary results of a project conducted by a group of researchers of the University of Navarra, on the coverage of CC in the Spanish media. More specifically, it studies how scientific concepts related to climate change are explained in the two leading Spanish daily newspapers (El País and El Mundo), during the Copenhagen summit, in December 2009.

303. New Developments in Assessing the Culture of Science

Chair: Marin W Bauer (LSE)
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Discussant: Gauhar Raza (NISTADS, New Delhi)

304. Construction of PUS Index in China–The China 2010 Civic Science literacy Survey

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Abstract. China's CAST and CRISP conduct surveys of science literacy since the early 1990s in China. The most recent in that series has been conducted in early 2010, and some preliminary results of this survey will be presented at the meeting. The challenge of the 2010 survey was to strengthen the sample of data collection so that indicators are robust enough to conduct regional comparisons within China.

305. Shifts in Science Culture? The Science Culture Index for Europe 1989 to 2005

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Abstract. The European Union has an survey instrument called Eurobarometer, which since the 1970s in irregular intervals conducts surveys of general attitudes of European to science and technology. A recent research effort achieve micro-integration of four of these surveys, which allows to conduct time-series analysis for EU12 and compare the changes and stabilities of these countries with regard to their science culture from 1989 to 2005 (2010). Some observations in that respect on the basis of an new index of 'science culture' will be presented to the meeting.

306. Literacy and Attitudes Measure in the Context of India's Youth Readership Survey 2009

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Abstract. NCAER was the author of the first all India Science Report in 2005. In that vain, the recent Youth Readership survey of 2009 included among other things a number of questions regarding the science culture of Indian Youth. The paper will present results from these questions, and compare the different regions of India on the relationship between science culture and readership activities of its youth.

307. Brazilian PUS Surveys 2010, 2005 and 1987: Change and Stability in Questions and Results

Luisa Massarani (FIOCRUZ, Brazil) & Ildeu Moreira (MST, Brazil)
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Abstract. Brazil had undertaken its first national survey of public attitudes to science back in 1987, this effort has recently been revived with a national survey in 2005 and a very recent one in 2010. The paper will document the development of the thinking behind these surveys, how the items have change and present preliminary results of the most recent research to the meeting.

308. [Symposium: Communicating Climate Change in the Media– With Lessons From Climategate]

Climategate: What's in it for Science Communicators?

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Abstract. The presentation will report on the media and public coverage of the email controversy which involved climate scientists and was largely reported as a huge scientific scandal (it was dubbed Climategate by the media). On 19 November 2009, thousands of e-mails and other documents sent by researchers from the Climate Research Unit of the University of East Anglia appeared on a public website. The controversy came from the fact that some emails were interpreted as showing that researchers manipulated raw data, hide climate information or influenced the peer-review process in order to make the case for global warming appear stronger than it is. In July 2010, several independent reviews rejected allegations that climate scientists had colluded to manipulate scientific information, but the researchers involved and their institution were criticized for a culture of withholding information. The presentation will focus on the key lessons that can be drawn from this case for the public communication of science.

309. Digital Scholarship and the Changing Nature of Scientific Publication: The Implications of 'Climategate' for Science Communication

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Abstract. Digital media have extended the number of channels that scientists (and other academics) use to communicate and share information. Social media, such as blogs and social networking sites, provide opportunities for scientists to communicate with others about their work in more immediate and informal ways. As such, digital technologies have the potential to make all stages of the research process more visible in the public sphere. They also offer, on occasion, some opportunities for interaction and engagement with a wider range of audiences and stakeholders. In these respects digital technologies are introducing novel demands on researchers who choose to communicate in these ways, requiring skills and competencies on the part of scientists that are encapsulated by the concept of digital scholarship.

In this presentation we explore this developing context via a high-profile case study: the publication of emails from the Climatic Research Unit at the University of East Anglia (also known as 'climategate') in the run-up to the United Nations Copenhagen Summit (also known as COP-15). We will describe 'climategate' as a story of 'private' and 'public' communication, of freedom of scientific information and illegal hacking, all delivered via peer reviewed scientific papers, IPCC (and other) reports, websites, the blogosphere and professional news media.

In analyzing this episode we will briefly explore the role of professional media and social media in communicating information about the scientific consensus of anthropogenic climate change around COP-15. The findings of three reviews of 'climategate' will also be discussed in terms of their implications for science communication.

This episode may indirectly influence the ways that scientific knowledge is produced and verified, and what information and data are required to be archived for circulation in the public sphere when a peer reviewed paper is published. In the light of this, we argue that there is a need to develop norms to inform scientific publication in the widest sense of this term, to include all forms of science communication that are available in the public sphere.

310. Science, Politics and the Media: The Climategate Disputes in France

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Abstract. Science is increasingly part of the public domain : scientific controversies, previously well protected from the public eye by the tacit rules which organise scientific communities since the XVIIth century, are more and more open to public inquisitiveness. There is a growing interdependence between science and politics. Political decisions must rely on scientific expertise while scientific and technological options and choices are evermore subject to political bargaining. The debate on climate change and global warming is a good example of this new direction in science history (history of science).

This paper will deal with the most recent media events concerning the "climategate" in France. We shall start with the analysis of Claude Allègre's L'imposture climatique ou la fausse écologie, which was published in February 2010 and triggered a number of responses of all kinds in the media. C. Allègre is a well known geophysicist and former minister of education and research in the last socialist government. His climatoskeptical views were already well known and widely discussed in the media but his book appeared as the last straw. The french community of some 400 scientists, as different from each other as the disciplines and the specialities they represent, but all involved in the French branch (GIEC) of the IPCC, published a petition against the « lies » of Claude Allègre, asking their minister, Valérie Pécresse, as their employer, to reassert the scientific status and the seriousness of their work and to prevent futher public diffusion of additional «lies» by Claude Allègre and his colleague, Vincent Courtillot. Allègre's crime according to the signatories of the petition is to have published under the cover of scientific background without peer control. This petition, in turn, was followed by numerous reactions in the media, generally condemning this appeal for a political intervention in what was considered by most journalists and popularisers as a scientific debate between experts. The petition also showed the difficulty for these scientists, highly specialised in various fields, to accept their position as lay people in relation to each other's narrow competence over this or that aspect. The general issue of climate change and global warming with its political overtones leaves them helpless within the public debate. Hence, this curious demand of the community to reaffirm the necessity of a clear cut separation between science and politics in order to recover an autonomy which would be provided by a politician! Such a move is contradictory as many debaters like Jean-Marc Lévy-Leblond or Benoît Rittaud have pointed out in the media. Bruno Latour's position presented in Le Monde (22nd of May, 2010) is also ambiguous. Recognizing the impossibility to disentangle expert's science from politics, Latour advocates for a new distinction between science and research. While the former is an area of undisputable facts prone to be popularized in a traditional way (reinforcing autonomy and control of the scientific communities on the public divulgation of «their» knowledge!), the latter integrates uncertainties within the field of scientific experimentation as well as within the field of political action. According to Latour, the «good» link between science and politics should involve a confrontation with uncertainties in both areas under the arbitration of the cautionary principle. How could the media deal with such a «proposal» which would radically change its role in the management of the relationship between science and society ? It is within such a media turmoil that the journalist Sylvestre Huet from the newspaper Libération, published his response to Claude Allègre (L'imposteur, c'est lui, Paris Stock, April 2010) pointing out all the scientific mistakes and inaccuracies in the book in order to discredit the political argument of the geophysicist. The journalist is attacking Claude Allègre as a scientist with scientific arguments while the latter is dismissing these arguments by relying on the global political relevance of his argument against the anthropic origin of global warming. Within this paper, we seek to identify the scientific and political stakes of this strange controversy.

311. Developing Scientific Literacy among Student Teachers: Using Media Reports of Scientific Research in the Classroom

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Abstract. Teachers, scientists and the media have important role in shaping young people's perceptions of science and science career choices. Today, it is widely accepted that science education should equip students with the knowledge and skills to become scientifically literate citizens (Elliott, 2006). Although the meaning of scientific literacy in the context of school science has been debated (Osborne et al., 2003), it is widely agreed that the ability to analyze and interpret text including simple media reports of scientific research is an essential aspect of public engagement with science and scientific literacy (Norris & Phillips, 2003). An understanding of science, therefore, requires the ability to read and understand the essential points of media reports that involve science. Because of its potential significance for personal and professional decision-making in a democratic society as well as participation in public policy debates over societal issues (e.g. debates on socio-scientific issues), the ability to engage critically with science in the media is seen a valued outcome of a contemporary science education and a manifestation of scientific literacy (Jarman & McClune, 2007). This study investigates how student teachers evaluate popular reports of scientific research and investigates their views on the use of such reports as teaching resources in the classroom. Participants were 32 primary student teachers enrolled in a science methods course in which they were introduced to some techniques (Elliott, 2006; Jarman & McClune, 2007; Norris & Phillips, 2003) to help them critically evaluate media reports of scientific research. At the end of the course, the participants were asked to find a popular report of science and write a report on its evaluation. The media reports were chosen from recent popular science magazines, nonscience magazines and newspapers. A document analysis of 27 reports was undertaken to evaluate the quality of the reports prepared by the student teachers. The reports prepared by student teachers were examined for a range of evidence such as the newsworthiness of the story, the portrayal of science and scientists, bias in reporting, the theoretical ideas involved, the accuracy of information and association between data and claims. The preliminary results indicate that student teachers valued the opportunity to analyze media reports of scientific research and gained greater confidence in the use of similar techniques in their teaching at schools. Some implications for teaching about scientific literacy and further research are discussed.

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VII

Communicating from Hard Science to soft Science

312. University to the City: Science Goes Out

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Abstract. In today's society, scientific and technical knowledge is present in most of the acts and activities of everyday life. However, the diffusion and the overall level of knowledge run at a slower rate than production. Science and technology are integral elements of the culture of individuals and societies and as such his attention. The studies and surveys on Social Perception of Science and Technology show that the degree of public interest in this kind of issues is high but not the degree of information received signal. Scientific and technical issues, their consequences, risks and benefits are issues on which society wants to be better informed to participate.

Science and technology must become more familiar to the public. It is therefore necessary to strengthen its presence in the areas not only formal but also informal spheres. That is why the research group on dissemination of knowledge established in the Faculty of Education and Humanities of Melilla (Universidad de Granada) under the research project "Towards a Knowledge Society and Information, Public Dissemination of Knowledge in the Autonomous City of Melilla" funded by the Research has been conducting since 2004, in favor of disclosure not only of science and technology, but knowledge in general, a series of activities under title "Dissemination of Knowledge Week."

This activity, carried out regularly to coincide with the celebration of the European Week of Science and Technology during the month of November, is intended as a communication channel between knowledge and society, in particular among university as a core source of knowledge and the society in which the center is built trying to sensitize the population on those aspects of knowledge and in particular of Science and Technology, which affect their daily lives and increase scientific culture of citizens.

In this paper we present this initiative, science and citizenship. Show activities in each of the Knowledge Dissemination Weeks that have been made since 2004, such as activities (workshops, exhibitions, conferences, roundtables, radio and television talk shows, etc). This is aimed at all audiences, from school children, the first stages of education to adults and the general public, as well as a means to develop them. Highlight the close collaboration between universities and the media with the understanding that both should work hand-in-hand in order to provide the public with reliable and relevant information. Each November knowledge in general, and Science and Technology in particular, developed by the University are carried into the city so informative. Citizens unite and enjoy science in a readable but rigorous fashion.

313. Role of Demonstrations for Effective Communication Of Chemistry and Green Chemistry Concepts

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Abstract. The demonstrations are widely accepted as complementary tools for science communication. With the progress of time and technology the use and mode of demonstrations have also been modified. Modern cognitive science research reveals the requirement of student's active role for better perception of conceptual learning. Strategically this can be achieved more effectively in an atmosphere in which ideas are openly generated, debated and tested through demonstration experiment. Both the laboratory experiences and demonstrations are found to activate student's interest for initiation & perception of learning. This paper will provide an overview of the role of chemical demonstration experiments for conceptual learning of chemistry as well as green chemistry.

Keywords: Chemical demonstration, Cognitive science, Conceptual learning, Green chemistry experiments

Introduction

Most of the chemistry teachers in particular and science teachers in general, feel the need of demonstration as an effective and complementary tool of communication for conceptual learning. Because of its wide acceptance nowadays science demonstrations techniques are used for the betterment of teaching learning processes. Starting from 1950 the mode of science demonstrations became more popular teaching strategy. With the progress of time and technology, especially in the era of information & communication technology, the use and mode of demonstrations have also been modified and proliferated1. According to the modern cognitive science research student's active role is vital and learner's mind must be engaged effectively for better perception & transformation of conceptual learning. In this relation lectures and instructions alone are not sufficient to promote conceptual learning2. N. W. Rakeswtraw3 rightly stated that the ultimate object is the ability to think abstractly and this can be attained only by learning to think correctly. No teacher can hope to instill enthusiasm of understanding into the learner by merely talking about the chemistry, without actually showing the processes and materials i.e. demonstration. At the same time to achieve more understanding, greater concreteness in teaching strategies and in instructional materials are also inevitable4. Beside demonstrations laboratory classes play a vital role in learning chemistry, even though demonstration experiments are very important for growing interest and also for proper perception and accumulation of conceptual learning. Both the laboratory experiences and demonstrations are found to be the powerful tools for activating student's interests and focusing their attention for initiation of learning and perception of conceptual learning of chemistry and green chemistry. Chemical demonstrations can also be used complementary tools, where practical class works are not possible. It can allow the students at least to see the experiments, which they otherwise would not be able to share. So the challenge of chemistry teachers is to attract and engage the active and visual learners by the use of well planned and effectively presented classroom demonstrations.

On the other hand green chemistry [i.e., design of chemical products and processes that reduce or eliminate the generation of hazardous substances] become an essential part of modern chemistry. But very little educational researches are found to promote the demonstrations for effective communications on green chemistry education. Although some reports on chemistry demonstrations workshops with educators are repoted5-6. The concept of learning with demonstration can also be applied for effective learning of green chemistry using green chemistry concepts, principles & experiments. Demonstration experiments based on green chemistry concepts and practices can provide pedagogical benefits to cope with the contents of greener curriculum [i.e., with the practical advantages of improved safety & reduced hazard]. Participatory demonstration of simple green chemistry experiments showed great impact on learner with the advantages of stimulating to find new/similar experiments to replace the existing hazardous one by them7. So the development of demonstration experiments based on green chemistry principles and practices for green chemistry communications are inevitable. This in-tern will definitely help to cope with greener curriculum of modern chemistry for sustainable development [reduction of adverse consequences of the substances/ chemicals/ techniques that we use or generate] of future world. This paper will provide an overview of the role of chemical demonstration experiments for conceptual learning of chemistry as well as green chemistry. Basis of selecting/choosing right kind of demonstration to prepare and conduct the same will also be attempted with critical analysis of some selective chemistry and green chemistry experiments.

Demonstration & Conceptual Learning

The primary job of a teacher is to generate and evolve the proper resolution of cognitive conflicts among the learners. Strategically this can be achieved more effectively in an atmosphere in which ideas are openly generated, debated and tested through demonstration experiment, either in lecture demonstration or in laboratory demonstration. Textbooks alone are not sufficient to develop a personalize understanding of concepts. Interesting demonstration can create links between previous knowledge and new concepts of learning among the students8. Chemical concepts may developed by analysis of experimental observation and careful reasoning. Series of observations and logical deductions will motivate learners to questioning to understand and reconstruct the concepts through discovery mode. Observing a new experiment/ demonstration/ incident definitely motivates and prompts student to ask questions with reasoned responses and finally to investigate & to draw conclusions that explain the foregoing observations. All these in-tern will enhance the cognitive skill of critical and analytical thinking followed by evaluation and synthesis, which is most essential to success in chemical sciences.

Different kinds of strategic demonstrations can be used with proper judgment and according to the need of the both of students and topics. (a) Classroom demonstration (syllabus oriented concept development) with the help of actual performing the demonstration experiment before the students. (b) Popular demonstration experiments with hands-on activity using easily available & inexpensive materials and active participation of students. (c) Magical demonstration to explore myths and mysteries of incidents. (d) Virtual demonstration with the aid of computer animations and video presentation9-10, etc. Choice of right kind of demonstration largely depends on targeted audience, teacher's skill and relevance with suitable concepts or topics.

Comprehensive Planning

The Demonstrations of all levels to communicate effectively should be of well planned to attract and engage the active and visual learners in modern classrooms. Success in effective communication largely depends on proper planning and choices of strategic type and/or proper blending of many types of demonstrations. Basic components of a good demonstration are;

(i) Complete, accurate instructions with purpose/ objectives,

(ii) List of equipments and materials with convenient sources for all,

(iii) Brief explanations of the concepts of chemistry & green chemistry involved,

(iv) Short description of stepwise demonstration procedure in simple languages, and

(v) Post demonstration works.

Steps for individual demonstration:

STEP-1:

Instruction sheet get ready with the following points;

Title of Demonstration,

Clearly stated academic purpose/objectives, Foundation/previous knowledge review to be required to link students' past experiences,

Explanation of the concepts of chemistry & green chemistry involved,

Materials and Equipments required,

Times required,

Short Introduction on Demonstration/ Experiment,

Presentation procedure,

Post demonstration testing and Conclusions.

STEP-2:

Procurement of Materials and Equipments; Mostly with the help of students and should be of inexpensive, easily available, popular/known and eco-friendly.

STEP-3:

Foundation of presentation;

Discussion of previous knowledge is required with short introduction that connect the demonstration to the previous knowledge attracting students attention for careful observations and questioning11.

STEP-4:

Performing the actual demonstration; The teacher will perform the demonstration with active participation of the students. Materials/incidents/happenings are to be properly observed by students. Involving students in hands-on activity will encourage students for timely questioning to understand the incidents through immediate feedback/ discussions with peers and or instructors, i.e., active learning.

STEP-5:

Concept development;

Series of observations and logical deduction will automatically lead the students for further questions with reasoned responses. Teacher will assist the learners to construct and reconstruct the concepts through discovery mode.

STEP-6:

Post demonstration Evaluation;

Allowing the students to test and reconstruct their new knowledgebase/ understanding with new examples/ evidences/incidents and helping them for appropriate understanding of corresponding concepts.

Sample Tested Demonstrations:

Demo–I: Flame Tests Using Common Household Materials12

Objectives:

The academic purpose of this demonstration is to identify elements from color emitting materials.

Foundation:

Salts, ions, elements, color flames, etc.

Concepts:

Elemental identification based on color flame.

Materials:

Common house hold materials.

For Boron; 2 tsp boric acid (H_3BO_3) and 1/2 cup of 91% isopropyl alcohol (C_3H_8O) are mixed.

For Sodium; Equal amounts of 70% isopropyl alcohol (C_3H_8O) and water are mixed and then saturated with baking soda ($NaHCO_3$).

For Potassium; Equal amounts of 70% isopropyl alcohol (C_3H_8O) and water are mixed and then saturated with cream of tartar ($KC_4H_5O_6$) followed by addition of 1 Tbsp of vinegar.

For Calcium; Equal amounts of 70% isopropyl alcohol (C_3H_8O) and water are mixed and get saturated with deicer ($CaCl_2$).

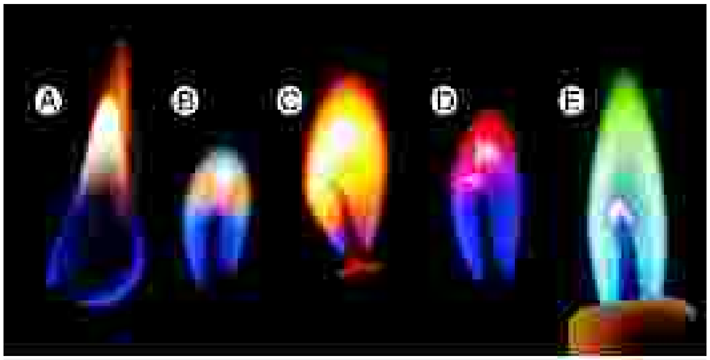
For Copper; 1 cup of ammonia and 1gm copper sulphate are mixed & shaken for 1 min, until solution turns blue. Then added one part blue solution to two parts 70% isopropyl alcohol (C_3H_8O). Etc.

Demonstration Experiments:

Household materials in mixtures of water and isopropyl alcohol are dissolved and the resulting solution is poured into a spray bottle. When the solution is sprayed as a very fine mist onto a flame generated by a wind-resistant grill lighter, a large flame is produced. The flame color depends upon the element present in the household item dissolved in the isopropyl alcohol – water mixture. Students are instructed to color in box of the element [in the periodic table] with the color of the flame observed.

Post demonstration Work:

In the post demonstration part students can easily find the possible element used in Colored Flamed Birthday Candles too.



(A) Isopropyl alcohol and water (B) cesium;
(C) Sodium; (D) lithium; and (E) copper.

Demo–II: Determination of the Formula of a Hydrate: A Greener Alternative13.

Objectives:

Academic purpose is to explain the principles of stoichiometry and gravimetric analysis.

Foundation:

Constant weight, water of crystallization, formula of salt hydrate, etc. are to be discussed.

Concepts:

Gravimetric Analysis;

Stoichiometry.

Materials:

Copper hydrate salts [Copper(II) Chloride dihydrate], Air-Oven, etc.

Demonstration Experiments: The determination of the formula of a hydrate is an experiment that introduces students to many fundamental chemical concepts including stoichiometry, the notion of a mole and nomenclature. Copper salts are being used because they are less toxic, less expensive, and recyclable and produce vivid color changes (blue to brown) during the experiment. Not only are students exposed to the concept of environmentally responsible chemistry, but are asked to determine the formula of a copper chloride hydrate salt by measuring the change in mass after water is evaporated from the sample. The lab is also made safer by dehydrating the copper salt using an air-oven instead of individual Bunsen burners. We utilize a copper hydrate salt that shows both a visual color change upon dehydration and ease of rehydration upon exposure to steam.

Post demonstration Work: Students are asked to calculate amount of water present per mole of experimental salt hydrate from the weight loss data, after getting constant weight. They will also report the gradual color changes. Finally teacher will assist them to find out the formula of a salt hydrate.

Demo–III: The Friedel-Crafts Reaction: Acetylation of Ferrocene7,14.

Objectives: Acetylation of ferrocene with a green alternative pathway.

Foundation: Green chemistry principles, Friedel-Crafts Reaction, Ferrocene, etc.

Concepts:

Electrophilic Substitution, ‘C-C’ bond synthesis and green method.

Green Principles:

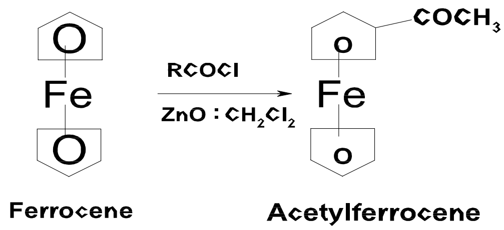
Less hazardous, Recyclable Catalyst and Energy minimization. Atom economy, etc.

Materials: Ferrocene, acidchloride, Zinc Oxide, Reaction set-up, etc.

Demonstration Experiments:

This experiment focuses on the Friedel-Crafts reaction - a powerful, widely used method of carbon-carbon bond synthesis that proceeds by the mechanism of electrophilic aromatic substitution.

Reaction:



Procedure

In this greener approach14 ferrocene was acylated with different acid-chlorides over eco-friendly ZnO catalyst at room temperature. The reaction completed in 15 minutes [monitored by TLC] and on normal work up acylferrocene was isolated characterized spectroscopically. The acylation of first ring deactivate the second thus only monoacylated product is obtained. The used ZnO was washed and reused (2-3 times) without loss of efficiency.

Green advantages:

(a) Eco-friendly easily available ZnO as recyclable catalyst.

(b) Room temperature reaction and simple method minimize the energy input.

(c) Small reaction time and less harmful method.

Non-green features

(a) Toxic acid-chlorides (RCOCl) are used as acylating agents.

(b) Chlorinated hydrocarbon, CH2Cl2 used as solvent.

The link to this laboratory procedure includes both pre- and post-lab questions.

Post demonstration Work:

Students have been self motivated to overcome the problems of removing non-green features and tried to find more green experiments. Instructor should guide with necessary information. They will also try for other suitable substrates.

Demo–IV: Solventless Friedel-Crafts Acylation with Carboxylic acids at Room Temperature14,15

Objectives: Acylation of aromatics with carboxylic acids as a green alternative acylating agent.

Foundation: Green chemistry principles, Friedel-Crafts Reaction, etc.

Concepts:

Electrophilic Substitution, Catalytic & Recyclable Pathway for C-C bond synthesis.

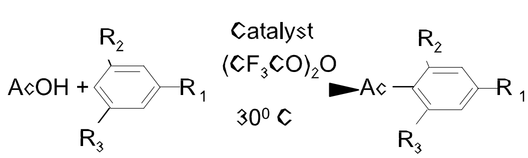
Green Principles:

Green Reagents, Atom economy and Energy Minimizations, Solvent less reactions, etc.

Materials: Bi(OTf)3 or Sc(OTf)3 with TFAA, Acetic acid, aromatic substrates, Reaction set-up, etc.

Demonstration Experiments:

Reaction



Catalysts: $Bi(OTf)_3$ or $Sc(OTf)_3$ with TFAA ; R1, R2, R3 = H / Me / OMe
etc. Procedure

In this method aromatic ketones are prepared in solventless condition at ambient temperature using recyclable catalysts [metal triflates] with trifluoroaceticanhydride [TFAA]. Both the aromatic and aliphatic carboxylic acids are used as successful green acylating agents. Required amount of catalyst were found 1% mole only. Here recycled catalyst specially, $Bi(OTf)_3$ was found to used without loss of activity11.

Green advantages

(a) Atom economy of the reaction is higher due to loss of by-product is only water. The water is a small molecule (18) of eco-friendly/ non-polluting nature.
(b) Reaction follows actual catalytic pathways [1% mole] instead of stoichiometric amount in conventional method. Catalysts can be recycled.
(c) Use of green acylating agents [RCOOH] and no solvent make the process green.
(d) Room temperature reaction and simple method minimize the energy requirement.

Post demonstration Work:
Instructor should explain how the green principles are applied to Organic synthesis, specially, towards applications finding more green methods.

Demo–IV: Bromination of trans-stilbene

Objectives: To Test the presence of double bond un-saturation through green methods.
Foundation: Green chemistry principles, conventional tests for un-saturation, etc.
Concepts: Double bond addition and in-situ reagents as green method.

Materials: trans-Stilbene - 1.8 g
HBr in water - 5.2 ml
30% Hydrogen peroxide - 7 ml
Ethanol - 10 ml

Demonstration Experiments: Reaction:
Stilbene + HBr + H_2O_2 → Ethanol + Dibromostilbene.

Green Procedure: Trans-stilbene (1.80 g) in ethanol (10 ml) was refluxed. The aqueous solution of HBr (33%) (5.2 ml) and hydrogen peroxide (H_2O_2, 30%) (7 ml) were added from a dropping funnel sequentially to this refluxing solution of stilbene. The colourless solution became deep orange in colour. Within 15 minutes, the orange colour disappeared. This indicates the bromination of stilbene. The solution was allowed to cool down. During this the precipitate due to stilbene dibromide separated out. The precipitate was filtered, recrystallized and dried. Conventional Procedure uses Non-green component of liquid bromine and Chlorinated solvents.

Green context

Corrosive liquid bromine is avoided
Atom efficient method and Water is the only byproduct in this method.

Conclusion

By using demonstrations with proper planning teachers can teach better and inspire the students more effectively.

Acknowledgement

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314. eLearning in Era of Communication

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Abstract. We are living in such a phase where we need continuous flow of information in each and every second. Even our today's life processes are running with the introduction of 'e' i.e., 'Electronic'. In the earlier age of civilization, the information was conveyed face to face but with the continuous upgradation of technologies it moved from 'verbal' to 'print' to 'multimedia' to very recently 'electronic technologies'.

Not only in the field of education, business, industry and other sectors, we need continuous information flow in agriculture also. As we know that 65-70% population of our country is dependent on the agriculture as their main source of livelihood, there is a urgent to give latest and continuous information flow on different aspects of agriculture so that the farmers can utilize the information and can compete with the other countries in area of agriculture production, marketing etc. not only this, farmers also want information what is going on all over the world in agriculture area so that they can modify or adopt the new technologies and walk with others. So, it is clear that we have to device such an information technology to benefit the farmers on every aspect on which they want information, and eLearning is the new effort in this direction!

eLearning can benefit every agricultural community around the world, from research scientists in universities or research stations to the poor subsistence farmers of developing countries. It can benefit persons of all ages, all locations, and bridge the gaps created by mountains, deserts, oceans, wars, and political boundaries. eLearning in agriculture can assemble resources and knowledge from distant places that may otherwise be unobtainable. It can connect farmers with far away researchers and experts. It can also dramatically increase the numbers of farmers who can be reached by single training programs. The framers of one country can share the information from the other country on any related aspects.

It can help reach out to the masses. The biggest advantage of eLearning lies in its ability to cover distances. The only requirement is an internet connection which is easily available and at one's own place. eLearning has become a widely accepted method of training and education within schools, colleges and organizations and can be used effectively as mass communication method to reap the gap between the technology generation and adoption.

It seems imperative that eLearning would coexist with other technologies and ways of acquiring knowledge and as soon as low cost PCs would be made available and broadband will penetrate deeper, particularly in rural areas, there are chances that e-learning will strengthen. The government needs to stimulate a learning culture and eLearning must become a policy issue. Also there is need to recognise the eLearning industry as a separate forum

The major hindrance to the acceptance of eLearning can be attributed to the Indian mindset that is more inclined to traditional classroom learning. The programme has to be well designed and publicized well so that it can take off by word of mouth. India is a multilingual country and most of the population knows vernacular language. Hence to make eLearning successful in India the digitized text has to come in these languages also. Rural India can benefit only by establishing eLearning centres with in local languages and the learners would be able to cross cultural boundaries by collaborating with learners from other cultures thereby reducing the gap of digital divide.

315. Communication of Science and Technology as an Instrument for Social Inclusion

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Abstract. In Brazil, it is a constitutional right that every citizen should have access to knowledge. In this context, it is the mission of the Department of Popularization and Diffusion of Science and Technology to make sure that scientific-technological knowledge is accessible to all. Therefore, the Department promotes and supports events and activities related to science communication and diffusion, in order to reach peoples of all ages, cultural backgrounds, social classes and education. In this context, we pay special attention to The National Week of Science and Technology, an effective tool for science communication and promotion of social inclusion in Brazil.

Keywords: Communication, National Week, Popularization, Science, Social Inclusion

Introduction

Brazil is a large country. Most of the scientific and technological production and dissemination happen in the South and Southeast regions, where the most prominent universities and science centers/museums are located. As a result, only 1% of the population visit a science museum each year. Hence, we face the great challenge of bringing science and technology to isolated regions, where people do not have easy access to such knowledge, and in most cases do not understand the value of science and technology for their lives and for the development of the country. Over the past years there has been an expansion of the actions related to the popularization of science and technology in Brazil, but the structure is still fragile and limited.

In face of this issue, the Department of Popularization and Diffusion of Science and Technology (henceforth “The Department”) of the Secretariat of Science and Technology for Social Inclusion (SECIS), promotes and supports science and technology events and activities, giving priority to the poorest or underprivileged parts of the country, in order to give these vulnerable people an opportunity to learn about science, technology and the scientific development and research in the country. The main purpose is to engage municipalities and local actors so that they will be responsible for designing and implementing activities or events that are most suitable in terms of the local characteristics, such as population (education level, cultural background, etc) and the scientific gaps that exist in their city or region. In supporting local actions, The Department intends to potencialize the learning process and promote social inclusion.

Having this in mind, one of the most important instruments The Department has for science and technology dissemination and popularization throughout the country is the National Week of Science and Technology (henceforth “The Week”). The Week was established in 2004, and its main goal is to mobilize the population, especially children and teenagers, around themes and activities of science and technology, stimulating creativity, scientific thinking and innovation [1].

To implement The Week, each estate has its own local coordination and counts on the active participation of city and estate governments, of education and research institutions and scientific-technological entities.

The paper is structured as follows. In Section 2 we present in more details SECIS and The Department, with their main lines of action. Section 3 introduces the National Week of Science and Technology, its history over the years, its activities, its growth and reach. In Section 4 we describe how communication of science can be used as a tool for social inclusion. Finally, in Section 5 we present our conclusions and future steps.

Actions for Social Inclusion

The promotion of social inclusion has been one of the main lines of action of the Brazilian Government since 2002. When President Lula took over, he committed himself to the improvement of the population’s standard of living, to the creation of new jobs and generation of income, with special focus on the underprivileged.

In this context, the Government created, in 2003, the Secretariat of Science and Technology for Social Inclusion at the Ministry of Science and Technology (MCT). The mission of SECIS is to promote social inclusion through actions that make use of science and technology to improve quality of life, stimulate employment and income generation and lead to the sustainable development of the country.

Regarding the strategic priorities of Science, Technology and Innovation (CT&I) for Social Development, SECIS follows two lines of action:

- Popularization of science, technology and innovation and the improvement of scientific education; and
- Diffusion of technologies for social inclusion and social development.

The Department of Popularization and Diffusion of Science and Technology works under the first line of action above. Its role is to promote and support any activities related to science and technology popularization, such as science fairs and olympiads, science exhibitions, museums, science centers, publications, television and radio programs and films. In order to enable these initiatives, The Department acts together with education and research institutes, scientific entities, governmental organs, newspapers, television and radio stations. The Department also works to strengthen scientific journalism.

Two examples of the events supported by The Department are the Brazilian Fair of Sciences and Engineering (FEBRACE) and The Brazilian Mathematics Olympiad of Public Schools (OBMEP). FEBRACE is a national fair that stimulates the young scientist. It plays an important social role, encouraging creativity and reflection in students, through the development of projects with a strong scientific basis in the different areas of sciences and engineering [5].

The Brazilian Mathematics Olympiad of Public Schools (OBMEP) is directed to public schools, and has the commitment to show the importance of Math for the future of these youngsters and for the development of the country, besides encouraging young talents and giving opportunities for them to pursue scientific careers [2].

The diffusion of science and technology plays an important role for the development of citizenship, where social inclusion is a natural consequence. Also, it greatly contributes for the consolidation of a strong scientific culture, where science communication is one of the most important factors. In this context, the National Week of Science and Technology is the most successful tool The Department possesses to extend its reach towards all those who are eager for scientific knowledge.

The National Week of Science and Technology

The Week was established in 2004, by means of a presidential decree. It intends to show the importance of science and technology in our lives and for the development of the country, and also offer an opportunity for the Brazilian population to get to know and discuss the results, relevance and impacts of scientific and technological research and applications.

All those who are interested may participate in the activities of The Week. The main actors involved are: universities and research institutions; public and private schools; institutions of technological education, centers and museums of science and technology; scientific and technological entities; research support foundations; environmental parks, conservation units, botanical gardens and zoos; estate and city secretariats of science and technology and education; public and private companies; journals, television channels and radio stations; governmental organs; non- governmental organizations and other entities of the civil society [1].

Among the activities of the Week, there are science tents in public squares; open days in research and education institutions; science fairs; contests, workshops and seminars; scientists going to schools; scientific initiation journeys; scientific excursions; events integrating science, culture and art. In terms of science communication, we can cite the distribution of books and 350,000 copies of the National Week of Science and Technology Journal, the exhibition of films and scientific videos, and the broadcast of science popularization programs on radio and television. Still, 20 DVDs with television programs and scientific diffusion videos from different countries are distributed for public exhibitions in all estates.

Over the years, the Week has seen a substantial growth, both in the number of participating cities and activities developed, as can be seen in Table 1. In 2009, only in Brasília (the capital of Brazil), around 120,000 people visited the stands and exhibitions taking place at the “Tent of Science”, a giant tent erected at the heart of the capital during The Week. The fact that The Week reaches continuously more people, all over the country, clearly shows that it represents a very effective means of communicating science and technology to people of all ages, cultures, social classes and education level, with no distinctions.

Every year The Week has a different theme. On its first edition, in 2004, the theme was “Brazil, Look at the Sky!” and in 2005, “Brazil, Look at the Water!”.

From 2006, the themes were chosen to go hand in hand with an international or national relevant celebration or date. The Week´s third edition worked with “Creativity and Innovation” to celebrate the centenary of 14 Bis’ first flight (the first self-propelled airplane, designed by the Brazilian inventor Santos Dummont). A replica of the plane flew over the Ministry Esplanade in Brasília during The Week. Thousands of educational and diffusion activities paid homage, throughout the year, to the great Brazilian inventor Santos Dummont.

In 2007, the theme “Earth” was chosen to celebrate the International Year of Planet Earth, established by the United Nations (UN). In 2008, The Week was set about “Evolution and Diversity”, because of the 150th anniversary of the Theory of Evolution by Natural Selection, by Charles Darwin.

Finally, in 2009, the theme was “Science in Brazil”, to bring to the general population knowledge about the science and the technology produced in the country. The International Year of Astronomy was also celebrated; thousands of Astronomy activities were promoted during The Week and over the year, reaching around 2,5 million people [1]. Thousands of books, folders

Growth of The Week over the years

Year	Activities	Cities
2004	1,842	252
2005	6,071	332
2006	8,654	370
2007	9,700	390
2008	10,859	445
2009	24,978	492

Table 1 – Yearly growth of The Week in the country, in terms of the number of participating cities and activities developed [2].

and booklets about varied themes (Santos Dummont, Carlos Chagas, Brazilian scientists, Astronomy, experiments, etc) were distributed throughout the country.

This year, The Week happened from the 18th – 24th of October, and its theme was “Science for Sustainable Development”. Beyond promoting the most diverse diffusion activities, it stimulated the debate about strategies and ways to use the Brazilian natural resources and its rich biodiversity sustainably, always aiming at an improvement of the socioeconomic conditions of the population. Science for Sustainable Development showed that science and technology are essential factors for the development with social, economic and environmental quality.

On the other hand, the General Assembly of the United Nations declared 2010 as the International Year of Biodiversity. The UN is stimulating all countries to seek a growth in collective awareness regarding the importance of biodiversity, by means of local, regional and international actions. The Week 2010 was designed to go hand in hand with this international effort.

Among the activities signed up for The Week this year, we highlight: science tents in several capitals of the country, like Brasília and Rio de Janeiro; a large popularization event, scientific initiation and science fair at the Federal University of Santa Catarina; the regional representation of The Week at Rio Grande do Norte reached the interior of the state, with the programs Research goes to School and School sees Science; joint actions in the North region, integrating the Brazilian activities with the Colombian National Week of Science and Technology; the first scientific display in Maranhão; the truck of science of the Catholic University of Rio Grande do Sul went to São Paulo.

Preliminary statistics indicate that in Brasília, for example, The Week was quite successful. Most of the attractions were interactive, with displays of live animals to illustrate the biodiversity of the country, hands-on experiences, videos, workshops on the most diverse themes, all related to biodiversity and sustainable development. Data for other estates and cities are still being computed.

The Week as a Tool for Social Inclusion

Brazil is a vast and diverse country, where people from different regions have very different cultural, educational and social backgrounds. Due to these huge contrasts, it is difficult to reach the whole country in equal measure and a considerable portion of the Brazilian population lacks access to scientific and technological knowledge, museums, science centers, research/educational institutions. This, in turn, contributes to the generation and perpetuation of a society that is illiterate in scientific-technological matters.

Historically, several factors are responsible for this long-standing problem. Usually, the interfaces between science and culture are ignored, as well as ethical questions, which leads to a natural disinterest in science and technology. Also, there is no recognition that scientific production is a process that follows a specific method, involving risks and

uncertainties. Science and technology are usually pictured as a black box: something of difficult understanding that is very exclusive, infallible and unquestionable. This picture reinforces the belief that science and technology belong in the universities and research institutes, and cannot be used to generate better life conditions to the poor. Added to the small academic valuation of outreach activities, we have, overall, a very restricted appreciation of the importance that science and technology have for social inclusion.

Moreover, in Brazil there is no tradition in planning public policies for science and technology popularization (even less with focus on social inclusion), which results in a very limited amount of funds destined to support or develop outreach activities.

As a consequence of all these factors, the general perception of science and technology in the country is still very incipient. A survey conducted in 2006 [3] showed that either people do not have the habit of going to museums/ science centers or these facilities do not exist where they live. When asked why they are not interested in science and technology, most of the interviewees answered that they do not understand it, therefore, they do not read about science in newspapers or books. Finally, people do not care to discuss science and the latest scientific-technological developments of the country because they think they have nothing to do with it. Paradoxically, most of the interviewees think that science brings more benefits than harm to mankind and agree that funds devoted to the scientific and technological development of the country should be increased. The survey interviewed 2,004 adults, men and women, of different education levels, socioeconomic classes and cultural backgrounds.

We conclude, therefore, that science in Brazil is not properly disseminated. Nonetheless, people are aware that this is an important matter for the development of the country, which means that more actions in science and technology popularization would certainly be welcomed. Note that whatever dissemination movement that existed in the country until now was not directed to poor people, which greatly contributed to their situation of severe social exclusion.

In this context, social inclusion can be reached in three ways: (i) by giving people access to knowledge so that they can understand what is around them and have autonomy to demand solutions for their problems; (ii) by giving people access to knowledge so that they do not feel less important or forgotten by those who had more opportunities in life; (iii) by showing people, particularly children and teenagers, that they can succeed in life and contribute to the development of the country, by following a scientific career, since science is not a black box – it can be understandable by all.

Regarding (i). It is important to start from the principle that the general knowledge of science and technology is part of our society and is the tool to promote the development of the country. Hence, it is essential that this knowledge is available to all, so that people can pose questions, make suggestions and follow the government´s actions and public policies related to science and technology.

The strategic priorities and investments made in science and technology by the government may be determinant for a solid improvement – or not – in the lives of the population. However, the population ignores these facts and feels powerless and disconnected when it comes to making decisions about what science and technology can do for them.

In May 2010, the Brazilian MCT, among others, promoted the fourth edition of the National Science, Technology and Innovation Conference, which analyzed the current situation of the Brazilian Science and Technology System, presented and discussed new proposals to subsidize the creation of a public policy specific for Science, Technology and Innovation in Brazil. This year, among its activities, the Week published and opened for discussion the results of the Conference, giving the population an opportunity to participate in the decision-making process regarding the future of science and technology in the country.

A short version of the "Blue Book", the final document containing all the resolutions and proposals that arised during the 4th Conference, was distributed as a supplement to The Week´s Journal. This document is now available for public consultation, so that everyone can give their opinions and suggestions about the plans that will guide the Science and Technology Policies for the next years.

Besides being an instrument for science popularization, The Week plays an important socio-political role in calling people to provide some feedback to the government as to what their most pressing needs are and what they expect for the future. The more people understand and participate, the more socially included they feel. And the more benefits they obtain from the developments of science and technology.

Regarding (ii). Since it is difficult to build and maintain museums/science centers everywhere in the country, people must have access to alternative science and technology events/activities. This is one of the main missions of The Week: to reach people who would not have access to scientific-technological knowledge otherwise.

It has been shown that informal events for science learning can stimulate science interest, build learner´s scientific knowledge and skill and help people learn to be more comfortable and confident in their relationship with science [4].

This argument can be verified by confirming that the public response to The Week has been very positive over the years. Its growth, in terms of the number of municipalities involved and activities developed, has been very noticeable, as mentioned in Section 3 and seen Table 1. This means that every year The Week touches more people and extends its reach further into the country. Especially in the North region of Brazil, where access to most of the population is complicated due to the extension of the Amazon Forest, and in the interior of the Northeast region where the poorest people of the country live, The Week brings a new horizon.

These regions are disconnected from the rest of the country and the local populations live in conditions of isolation. It is, therefore, very important to bring science to them, because they have the right to it, and because these actions offer them an opportunity to see their lives through a different point of view – they realize that they can have a better future with science and technology.

As an example, the National Institute of Amazon Research (INPA) promotes events and activities in communities all over the Amazon estate, by means of e.g. online lectures or itinerant exhibitions and displays. It is noticeable that the feeling of self-confidence and social inclusion of these communities are greatly enhanced when they realize that they are part of our society and have the same rights as everybody else (Carlos Bueno, private communication).

Regarding (iii). Science communication is a very important tool to interest people in science, encouraging them to follow scientific careers, therefore building up the human resources needed for the development of the country.

This is a challenge in Brazil, especially because children and teenagers are usually not fond of hard sciences, such as Math and Physics, which originates a serious lack of human resources in these areas, hindering the governmental efforts to promote the scientific and technological development of the country.

Therefore, it is crucial that science is brought to people in an exciting manner. The most effective way to achieve this goal is to create a connection between the science they see during The Week and their everyday lives. Once this connection happens, these people develop positive science-related attitudes, emotions and identities [4], feeling stimulated to pursue more, thus strengthening the scientific-technological culture in the country.

When local actors promote and develop scientific-technological events and activities, it is easier to create a bond with the local population. Direc access to phenomena of the natural physical world is fundamental in this context, where basic aspects of daily life are framed in light of associated scientific ideas [4].

We conclude this Section by reinforncing the many aspects of The Week. It can be used as a tool to reach isolated people and help them develop a connection with scientific-technological knowledge; as a tool to demistify science to people of all backgrounds; as a tool to interest people in science and encourage them to follow scientific careers; and as a tool to disseminate opportunities through which people can express their problems and what they expect from the government and their policies.

All these aspects are complementary and, together, they bring lasting social inclusion. When the population sees science and technology as an asset and not as liability, they can demand the use of the available knowledge to improve their lives. The cycle is closed when people have the chance to be heard, when they can use the knowledge they acquired to bring pressing issues to focus and demand immediate solutions.

Concluding Remarks

Since its first edition in 2004, The Week has been very successful, counting on a growing participation of the general public, institutions and municipalities. This shows that we are moving in the right direction; promoting local scientific events increases interest, proving that science is more accessible to learners when it is portrayed in contexts that are relevant to them, as indicated in [4]. It is worth mentioning that the success of this initiative stimulated other countries (Colombia, Uruguay, Bolivia) to create their own Science Weeks. However, there is still a lot to be done.

Among the main challenges are a greater involvement of the community and research institutions, a more effective integration with the educational system and the widening of the activities at the popular sector levels. Besides, the quality of the public communication that happens during The Week has to be continuously improved, providing more interactivity, stimulating the exchange of cultures, and shortening the relationship between science and technology and the reality of the population, always bringing to focus discussions and debates about the relevance and the ways of science and technology in local, regional and national scales.

Statistics show that The Week reaches around 5% of the Brazilian population. Since the results for 2010 are still being computed, it is possible that this number is higher today. In any case, the goal for 2022, the year of the bicentenary of the Brazilian independence, is to reach 100% of the municipalities in the country, a total of 5,500.

Even though the reach of The Week is still far from ideal, a new public opinion survey conducted in 2010 indicates that the scientific perception is increasing in Brazil. From 2006-2010, although still small, the number of people frequenting museums and science centers nearly doubled. The population, in general, is more interested and participative.

Thanks to the innovative efforts of The Department and the Secretariat to support local activities throughout the country, people in underprivileged regions of Brazil have access to knowledge that, until now, had been neglected to them. Hence, The Week is a very effective and democratic tool to bring science and technology to all Brazilian citizens, contributing to lessen the social exclusion problems we face and to minimize the gaps left by the still small number of outreach activities and events carried out in the country.

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316. Development of an Educational Program Framework for Science Museum to Foster Public Science Literacy

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Abstract. This granted research focuses on fostering science literacy for all generations. Since science literacy is a comprehensive ability of various elements and requires a long period of time for each person to acquire, science museums need to encourage people to keep learning science even beyond school age.

In the last conference of PCST in 2008, we presented an interim report of our research on developing a framework of educational programs to foster science literacy. Progress afterwards is going to be reported here and the idea on how to proceed for the future will be discussed.

Keywords: Generation, Program framework, Science literacy, Science museum, Society

Introduction

In Japan, research on science literacy has started since 1970's, with the main focus on introducing the research trend in the foreign countries such as the United States and the United Kingdom and discussing the features driven by a different culture. Many domestic researches focus on science literacy for school ages and little is discussed it for the general public.1 In the advanced countries of science literacy research including the United States, the United Kingdom, Canada, Australia, science literacy is placed as one of the goals of science education. Full Options Science System (FOSS) and Great Exploration in Math and Science (GEMS) are provided as a program system that aims to foster science literacy2. However, these attempts also target at formal education.

Science literacy is rephrased as comprehensive abilities and skills of science and it needs to be fostered throughout a lifetime. Thus, all educational institutions need to partner with each other and be responsible for providing opportunities to foster science literacy for the general public. Especially, science museums can be one of best places to create a continuous learning environment that maintains people's curiosity, interest, and positive attitude toward science - not only school students but also the general public at all ages.

This research integrates findings from the previous researches about science literacy within and outside of Japan in order to develop an effective system of continuous educational programs to foster science literacy for the general public.

Overview of the Research

To achieve this objective, we have started the research since 2007 based on two main activities; developing educational programs to foster science literacy and building a framework to organize them. Eight science museums from four areas in Japan have been involved in this research and contributed to practical activities including program design making a good use of particular learning resources of the museums. Twenty-four programs in total are conducted in the cooperating museums in Japan and evaluated to see whether the educational goals are achieved.

(a) Building a framework of continuous educational programs

National Museum of Nature and Science, Tokyo (NMNS) has been discussed what science literacy is for the general public and what is needed to incorporate the concepts of science literacy into educational operations in science museums3. NMNS exclaims that science museums need to foster people's science literacy based on the social needs. At the same time, they say that it is needed to develop and provide a system of programs that encourages learners to think the relationships between science and society as a venue to generalize what they have learned. In order for science museums to correspond to the diverse needs of people and solve problems that stem from people's life and social and economic activities, they need to broadly take in account of the relationships of diverse science disciplines with the other disciplines and with the daily life. The social sectors should partner each other in order to deal with various aspects of people's life and provide diverse learning opportunities that would fit various aspects in people's life- not only in schools but also throughout all generations.

Table 1 shows the four goals of fostering science literacy presented in the report of NMNS ; awe and appreciation, knowledge and understanding, attitude and communication. Each category has a detailed goal according to the five divided generations; preschoolers~ elementary school children, junior high~ high school students, university students, adults and families, and middle~ seniors. It considers visions of science literacy that are appropriate for each generation.

On the basis of the framework proposed by NMNS which focuses on 'generation' and 'goals of fostering science literacy', we further examined other aspects of the framework and core ideas are added, 'academic discipline' and 'link with society' as the results of the considerations. Appendix 1 shows the modified framework used in this research.

Table1. Four goals of fostering science literacy (National Museum of Nature and Science, Tokyo, 2010)

Awe and appreciation
Become able to deal with science and natural phenomena with curiosity and interest through hands-on activities.
Knowledge and Understanding
Become able to understand the characteristics of science and technology in order to make sense of familiar natural phenomena and the functions of technology.
Attitude
Become able to identify and analyze questions in phenomena and investigate the solution by applying diverse knowledge and ideas by self.
Communication
Become able to express appropriately what has been learned to the other people, and make decisions applying scientific knowledge and attitude in the social context and considering benefits and risks. Become able to participate in developing a sustainable society by returning the wisdom to society conveying own knowledge and skills to the next generation.

(b) Developing educational programs

In developing the programs, the four academic disciplines were set as follows; life, human and the society, space, earth, environment and the society, and materials and the society, and technology and the society. It was determined by reference to the research conducted by Kitahara proposing the visions of science and technology literacy based on seven different disciplines4. The programs have been developed based on the target generation of the year since 2007 and a theme of programs was also determined for each discipline throughout the four years. The sixteen categories in the framework divided by the academic discipline and generation are to be fully filled with the programs by the end of this year (See Apendix1). Twenty-four programs in total are conducted in the cooperating museums in Japan and evaluated to see whether the educational goals are achieved.

All programs contain hands-on activities including observation, sketching, coloring, crafting and experimenting. As a link with society has been carefully considered in designing the programs, participants' interest and free-choice learning are assured. Following is a brief overview of major program implementation:

Life, human and the society:

'Food and health' is the theme of this discipline, aiming to understand natural life and interaction between human and nature with a familiar view point seeing natural life as a food. "Coloring in Pictures at Science Museum' encourages children to understand the features/appearance of the animal better by closely observing the specimen of animals that people eat in the daily life and coloring it on a sheet of paper. This program was implemented in a "first-come, first-served" basis and aimed at facilitating children's sensitivity toward science in a creative way5.

Space, earth, environment and the society

The programs of this discipline have been developed with the theme 'Gift from the earth'. It aimed to seek answers to a question asking 'where were we born? , where are we now? , and where are we going to go?' by finding social issues from a scientific viewpoint and making decision with knowledge. In 'Let's play with pebbles of rivers', children became able to notice that each pebbles on the shores of a river had different features- touch, color, smell, shape and so on, and through crafting the pebble that they chose, they tried to grow their creativity and the ability to tell others what they made. As the further learning, the program aimed to let the children know that there was the relationship between pebbles on the shores and rocks on the upper stream of a river.

Materials and the society

'Materials supporting our life' was set as a theme of this discipline, aiming to increase opportunities of the effective use of materials in our daily life. The programs help participants to gain a concept and a viewpoint at the micro level to understand materials and various chemical changes. 'Investigate the micro world' encouraged children to understand the shape of a material through observation of magnified pictures of the material. The children could see that a material looked different when magnifying through interaction with their family and museum staff.

Technology and the society

The programs of this discipline focus on a theme, 'Technology supporting our life', encouraging participants to choose the direction of technology supporting the modern society from the comprehensive standpoint in their life. 'Investigate electric energy through a pinwheel' starting from understanding of the electricity bill, children learned the basic mechanism of electricity, the role of electricity in the daily life. It led to the discussion on how valuable electric energy is, and why we should care about energy conservation.

(c) Evaluating the educational programs

In a process of evaluation, the framework of science literacy proposed by NMNS which shows the visions when fostering science literacy in science museums was reexamined and revised based on the literature that shows the basic concepts and examples of science literacy. This enabled us to evaluate programs with clear and measurable viewpoints resulting in a more practical and feasible evaluation6. Literature referred includes PISA 20067, Pan Canadian Protocol8, Generic Learning Outcomes9, Twenty-First Century Science10, and Iowa Assessment Handbook11 .

The viewpoint of the evaluation in this research is to measure the extent how the program contributed to fostering science literacy. However, science literacy should be fostered with taking enough time as mentioned earlier and it is quite challenging to measure it only within what they experienced during the program. Thus evaluation in this research included how their further interest and positive attitude toward science learning was stimulated by the program as well as the achievement of the goals in the program and the awareness of science for the participants.

The actual procedure of the evaluation is divided into the following three processes.

(a) A framework of evaluation was developed based on the framework of fostering science literacy proposed by NMNS with referring literature on science literacy. The evaluation framework can be incorporated practically into program development and be feasible in evaluating programs

(b) Viewpoints of evaluation are chosen from the evaluation framework based on the goals, contents, and targets of the program. These viewpoints are not limited to the ones.

(c) Evaluation methods and tools are determined based on the items chosen to evaluate the program, which include questionnaire to the participants, observation of participant's behavior, and analysis of the worksheet completed by the participants and so on.

Research outcomes and future prospects

In this research, we developed, implemented and evaluated programs for all generations. Each program featured aspects of facilitating sensitivity, deepening understanding of scientific knowledge and concepts, facilitating scientific thinking and making right decisions in the social context, and enhancing the ability to communicate and apply scientific findings.

Although a number of programs are conducted in museums, no study has been found that reported a program system based on diverse generations including adults. This research has attempted to develop such a program system throughout the generation, which is quite original.

There are overall outcomes from the research as below;

(a) A focus on science literacy in developing programs showed validity of the program and correlation with science literacy. The approaches of the programs considering unique factors such as generation and a link with the society clarified special features of museum education.

(b) A variety of evaluation practices provided other museums suitable methods and tools to measure educational impact on visitors in informal learning settings.

(c) The framework of educational programs to foster science literacy;

- gave a new perspective on how people engage in science throughout lifetime.
- provided a common scheme responding to the situation of science museums across the country to organize its educational activities and draw a comprehensive educational strategy.

The programs need further improvement by implementing in various forms of learning settings, which would lead to expansion of the versatility and dissemination of the programs. Establishing the educational program database based on the framework of the research can also be effective in order to widely share the idea of fostering science literacy. 'Intergenerational learning' would be the next keyword of the research to enhance a diverse type of science communication and developing programs that connect between different generations needs to be considered. Although the aim of the research is to foster science literacy of individuals, it is assumed that communication between individuals would enhance science literacy of the society as a whole.

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317. Communication of Literature in Chemical Sciences to Researchers From Research Centers Situated in and Around Pune City (A representative model for communication of science to researchers)

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Abstract. Chemical sciences include a variety of branches related to most of the fundamental and applied sciences. Large numbers of research programs are engaged in association with chemical sciences at different levels. Awareness and ready availability of up-to-date reference literature is a basic for a quality-based and standardized research work. Considering the huge number of research centers and innumerable researchers, establishment of appropriate means for the communication of relevant scientific literature amongst these researchers will be a novel concept of current interest.

In India, there are numerous educational institutes, research centers, senior colleges and university departments where research is carried out in different fields. Large number of students, teachers and research fellows are engaged in advance research. However, the situation in most of the colleges and newly established universities is not ideal in connection of appropriate facilities for reference work. Many researchers and teachers are unaware about the necessity and importance of up-to-date scientific knowledge for research purpose. This problem has risen from communication gap between experienced and budding scientists. Therefore, a five component working model designed for the purpose of communication of science to these researchers will be highly appreciable in educational and research field.

Chemistry being the most fundamental science was selected as a representative example. With this background, the main object of this project was to undertake a detailed and systematic study of the current status of the use of literature in chemical sciences by researchers from selected research centers in and around Pune city. In this, the main task was to realize the present situation regarding the awareness towards the importance and necessity of reference work. This helped in creation of an appropriate foundation for planning and carrying out the research work in proper direction. For practical convenience, the researchers were classified into different categories like students, teachers, research fellows, research supervisors and other faculty members. Specific requirements of each category were considered. A survey of the type and nature of reference literature to be referred by research workers belonging to different categories was undertaken. From this survey, attempts were made to establish appropriate recommendations and communicate the same to researchers. This model was found to be useful to most of the researchers which resulted into a fruitful research work.

The five component model designed for actual working purpose included (a) personal interviews with researchers (b) communication through correspondence, questioner and e-mails (c) survey of departmental libraries (d) citation analysis of the dissertations (e) data of research publications in national and international journals and their assessment in the light of impact factors and citation index.

Keywords: Reference literature, Five Component Model

318. Postal Stamps: A Novel Approach for Public Communication of Science and Technology

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Abstract. Utilization of postal stamps for public communication of science with special reference to awareness of scientific progress and ideas is a novel concept. It can be effectively applied as a convenient tool for popularization of science.

The most easiest and economic means of communication and correspondence is provided through Department of Post and Telegraph of the respective nations. Postal stamps are the significant articles, handled routinely. Due to attractive and intellectual designs, these postal stamps are the subject of special interest and hobby for everyone, right from children to senior citizens. Accordingly, department of posts is skillfully employing these means of popularization and publicity for cultivation and nurturing science and technology within our society. Philately is a global organization of philatelists, established by the department of posts from most of the advanced countries, which is working at national as well as global levels. Publication and distribution of new stamps to philatelists is an efficient and regular job of philately. From the huge number of stamps published by philately, specific postal stamps can be selected.

Collection, classification and projection of postal stamps related to a specific area of interest, at appropriate educational and public places will be an attractive promotional activity. Actually, such exhibitions are organized by philatelists and concerned agencies in all important cities of world, including India. In such exhibitions, there is exchange of stamps amongst the interested philatelists. Along with the publication of new stamps, relevant literature related to these stamps is also published periodically by the department of posts and other concerned agencies.

As a part of our contribution in communication and popularization of science and technology through this novel approach, this project has been initiated. This includes collection, classification and preservation of postal stamps related to science and technology along with their projection and exhibition for education and research purpose. An attempt is been made to develop innovative means for communication of science to society by undertaking such activities.

Our project was concerned with the use of postal stamps for the communication of science to society. Stamps related to various aspects of science are divided into three groups as:

1. Stamps in honor of commemoration of reputed scientists
2. Stamps related to medicinal plants with importance in human health
3. Stamps devoted to significant inventions in the field of science and technology

Collection and presentation of these stamps will reveal the relevant details along with significant events to underline their use.

Keywords: Department of Post and Telegraph, Philately

319. Effects of Newspapers in Education (NIE) Intervention with News Reports about Global Warming: A Cognitive Learning Perspective

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Abstract. The purpose of this study was to exam the effectiveness of an intervention of Newspapers in Education (NIE) which focusing on global warming. A nonequivalent experimental control group design was used. The participants were 209 students in the continuing education division of a technology college in Taiwan. There were 106 students in experimental group, and 103 students in control group. The intervention materials were 150 newspaper reports about global warming selected from Taiwanese newspapers published in 2009. Students in experimental group read five reports each day for one month, while no any intervention was made in control group. The results showed that when media usage behavior and issue involvement in global warming were controlled, the intervention of NIE had significant effectiveness on the concept connections between related concepts (including global warming, climate change, green industry, green consumption, and environment policy). Attitudes toward green consumption and green consumption behavior also increased significantly in experimental group. This study suggests that news media is an effective tool for dissemination of science information. Science news reports selected appropriately could be used as educational materials for science education.

Keywords: global warming, Newspapers in Education (NIE), news, science education, science communication

Introduction

Since the industrial revolution, people have been extensively using fossil fuels such as coal and oil in pursuit of economic growth, resulting in a significant increase of greenhouse gases in the atmosphere (Huang, 2007). In consequence greenhouse effects have caused an increase in the average global surface temperature, and have had a serious impact on the global climate. In addition to the international community's commitment to the reduction of greenhouse gas emissions, people have to seriously consider the post-global warming state of the environment and adjust existing life styles, to face the seemingly irreversible global warming and climate change phenomena (Ku, 2008).

People have more and more diverse channels of knowledge acquisition. In everyday life, knowledge learning through informal channels, such as travel, visits, mass media, newspapers, magazines, the Internet, and multimedia, have been gradually increasing. Millar (1997) pointed out that science or technology impacts can be directly perceived by the general public mostly through news reports on social or scientific issues. Cultivation theory pointed out that the long-term influence of media will affect people's perceptions, attitudes, and behaviors (Morgan & Signorielli, 1990). Among the different types of mass media, newspapers are an important source of information.

In the consumer-oriented era, the collective environmental awareness of consumers has a dominating influence on the market toward green production. Promoting the cognitive between the environment and consumption behavior through public education is a key to the promotion of green consumption. Studies on Newspapers in Education (NIE) of global warming-related issues are scarce. This study can help us to understand the effectiveness of NIE about global warming.

Economic growth

Over the past few decades, unprecedented economic expansion has made the global economy a trend. The focus of international development in the past 20 years has been to accelerate the integration of developing nations into the global economy through the structural adjustment plans and policy mechanisms of the International Monetary Fund and the World Bank (Roseland & Soots, 2007). The industrial economy has changed tremendously. Cities dominated by industry for a long time are now ready to grab the next wave of global economic opportunity, which is linked to green and clean development (Sawin & Hughes, 2007).

Global warming

In recent decades, due to the rapid increase in population and fast industrial development, carbon dioxide generated from the heavy use of fossil fuels, such as coal, oil, and natural gas, has been far greater than the level of carbon dioxide formed naturally. Coupled with mankind's deforestation and vegetation destruction, as well as the reduction of tropical rainforests, chances to convert carbon dioxide to organic compounds through plants have been declining. Large quantities of greenhouse gases are being discharged, resulting in a rapid increase of the carbon dioxide concentration in the atmosphere and strong greenhouse effects (Liu, 2007).

Climate change

The rapid development of the global economy has resulted in a significant increase in energy use and a sharp rise in the consumption of fossil fuels. Coupled with the large-scale deforestation of land resource development, the global carbon cycle has been damaged, causing the recent warming trend and creating a significant impact on the climate (Ku, 2008). The rising average global surface temperature will have an impact to a certain degree on the weather systems in every region. More and more evidence suggest that global warming has started to cause chaos in the climate systems of many parts of the world, affecting ecosystems and endangering the stability of the human environment (Su, Lin, & Chen, 2008).

Environment policy

In December 1997, on the third conference of contracting members of the United Nations Framework Convention on Climate Change held in Tokyo, Japan, member nations adopted the legally binding Kyoto Protocol. The Kyoto Protocol came into force on February 16, 2005, requiring developed nations to reduce the emissions of six greenhouse gases between 2008 and 2012 (Chan & Hung, 2007; Huang, 2007).

Green industry

In recent years, the EU has released a number of EU environmental directives or regulations, such as RoHS, WEEE, and EuP, directly forcing manufacturers of products entering the EU market to comply with specific environmental requirements. The EuP directive stresses that manufacturers using energy products should assess the environmental impact of their products at various stages, including raw materials, manufacturing and assembly, transportation and distribution, usage and maintenance, and discharge and recycling, and propose concrete measures to improve their environmental impact. Wang, Kuo, & Tang (2007) pointed out that industries and supply chain systems should respond in real time and actively integrate the considerations in the environmental perspective in order to incorporate the ecodesign or design for environment concepts and technology during the product design stage.

Green consumption

Peattie (1992) believed that green consumption means that consumers are aware of environmental degradation and try to buy goods that minimize their impact on the environment, thus achieving their consumption purpose while reducing damage on the environment. Green consumption is the pursuit of sustainable and socially responsible consumption. The behavior criteria for consumers buying green products include reduce, reuse, recycle, regenerate, repair, refuse, and recover.

The global warming related issues summarized in this study included global warming, climate change, environment policy, green industry, green consumption and economic growth.

Methodology

The cognitive association graph of the global warming-related issues proposed in this study is shown in Figure 1, and was the framework of this study with a total of 30 paths of influence.

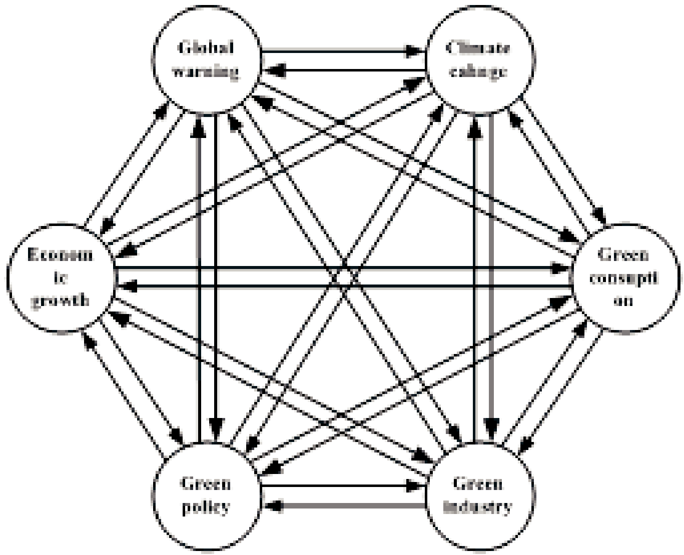

Figure 1. Conceptual model

Study design

This study used the nonequivalent control group design shown in Table 1. The pre-experiment and post- experiment tests used the same measurement tools. In this study, five variables were used as covariates, including number of hours per week spent reading newspapers, number of hours per week spent watching TV, number of hours per week spent listening to the radio, number of hours per week spent online, and degree of global warming-related issue intervention.

Table 1. Experiment design

Group	Pre-test	Intervention	Post-test
Experimental group	Y1	X	Y3
Control group	Y2		Y4

Subject

The research subjects were 209 students from the continuing education division of a technology college in Taiwan, who were divided into an experimental group with 106 subjects and a control group with 103 subjects.

Intervention

The intervention materials were 150 newspaper reports about global warming selected from Taiwanese newspapers published in 2009. Students in experimental group read five reports each day for one month, while no any intervention was made in control group.

Measurement

This study used self-developed questionnaires as research tools. The variables included connections between global warming related concepts, attitude toward green consumption, green consumption behavior, issue involvement in glogal warming issue, and media usage behavior (Shih Hsin University, 2007).

Results

Regarding connections between global warming related concepts, both the experimental group and the control group believed that there was a positive relationship between global warming, climate change, environment policy, green industry, green consumption and economic growth. To exam the effect of NIE intervention on cognitive, this study employed group as independent variable, post-test of connections between global warming related concepts as independent variables, and with pre-test of connections between global warming related concepts, issue involvement in glogal warming issue, and media usage behavior as covariates for validation. According to ANCOVA analysis results, after intervention, a total of 14 post-test variables of concepts connection have significant differences between experimental and control groups at p<.05 significance level (as shown in Figure 2).

To verify the changing effects of intervention on attitudes toward green consumption and green consumption behavior, this study used group as independent variables, post-test of the attitude toward green consumption and green consumption behavior as dependent variables, and with the pre-test of the attitude toward green consumption, green consumption behavior, issue involvement in glogal warming issue, and media usage behavior as covariates. The ANCOVA analysis results indicate that NIE had a positive impact on attitudes toward green consumption and green consumption behavior.

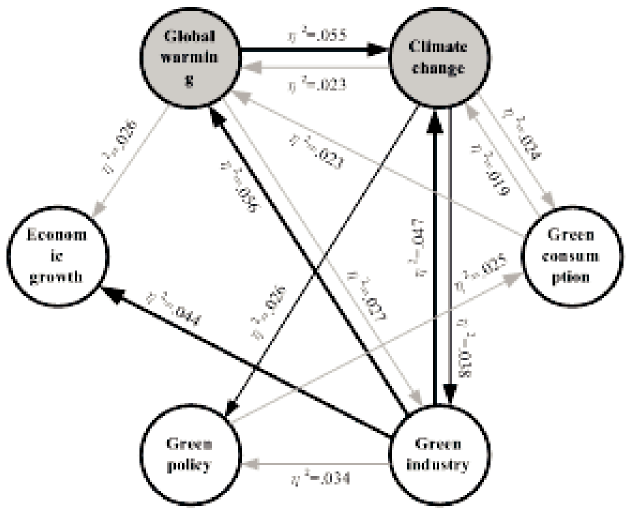

Figure 2. The effect of NIE on concept connections regarding global warming

Conclusion

The NIE intervention enhance concept connections regarding global warming

The NIE of global warming related issues has an enhancing impact on the concept connections of adult students. Such impacts can be found in issues such as the global warming, climate change, green industry, and other topics.

The effect of NIE intervention on green consumption was indirect

After intervention the cognitive enhancement effect of global warming affecting green consumption was mainly achieved through paths as “global warming→climate change→green consumption”, “global warming→climate change→environment policy”, and “global warming→climate change→green industry→environment policy→green consumption” .

The NIE had a positive impact on attitudes toward green consumption

For global warming-related issues, NIE can positively improve the attitude toward green consumption of adult students. The students believed that they should improve their consumption behavior, persuade others to participate in green consumption, affect enterprises to invest in green industries, support the green polices of the government, and should take on environmental protection responsibilities.

The NIE had a positive impact on green consumption behavior

NIE for global warming-related issues can help improve the green consumption behavior of adult students. They believed they would follow the green consumption behavior criteria, including reducing usage, the reduction of unnecessary waste, recycling, regeneration, repairing, the rejection of ecologically harmful products, and ecological restoration.

Suggestion

NIE can be an usful method for environment education about global warming

The results suggested that NIE can be used to environment education. Goverment and school can use NIE to the promot energy savings and carbon reduction. News stories can be edited for teaching materials according to learning theories and teaching material compiling principles.

Increasing causal links of global warming related concepts in news reports

As the experimental results suggest, the concept connections between global warming affecting green consumption was not yet significant. It was recommended to increas the causal links of global warming related issues to help readers in their cognitive construction.

Analyze the content of news reports regarding global warming issues

This study did not analyze the content and fram of news reports regarding global warming. In the future, it was recommended to further analyze the content to understand what are the newspaper cover news reportes about global warming.

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320. The Content and Frame of News Coverage about Global Warming in Taiwan

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Abstract. The news media is a major source of science information for the general public. The purpose of this study was to understand what are and how the newspapers in Taiwan cover news reports related global warming. Keywords searching and systematic sampling was used to select 548 newspaper reports on global warming from the three most widely read newspapers in Taiwan published from 2005 through 2009. A content analysis was conducted to analyze the content and frame of news coverage. The results showed that the main issues of news reports related to global warming were environment policy, green industry, climate change, green consumption, and global warming. The environment policy, green consumption, and green industry issues often appeared in conjunction with each other, and global warming and climate change often appeared in conjunction together as well. Reports on global warming were usually presented as a rational appeal style; as reports on climate change were often contained fear appeal messages, whereas, reports on environment policy, green industry, and green consumption usually contained information of reward appeal. This study suggests that for improving audience's knowledge about complex environment issues and problems, news reports on global warming should provide more links between related concepts. The practical implications of these findings and directions for future research are addressed.

Keywords: Global warming, News, Science communication, Content analysis

Introduction

The media is a public instrument of society, and one of its functions is education. According to the cultivation theory, long-term influence of the media would deeply affect the perception, attitudes, and behaviors of the public (Morgan & Signorielli, 1990). Mass media is an important source of environmental knowledge for the public, and is an important channel for the government and its people to engage in communications regarding environment policy (Wakefield & Elliott, 2003). For the perspective of science communication, what are and how the newspapers cover news reports related environment problem is an important issue.

Through analysis the new reports regarding global warming, the study was aimed to understand the contents, news sources, and reporting frames of news reports regarding global warming on domestic newspapers in Taiwan. Get an insight of the contents and frames of news coverage regarding global warming can help us understand the information received by the public through the news. In turn, the insight of these news reports can also be used government to carry out communication regarding environment policies, and for journalists to produce news reports regarding environmental science.

Methods

Sample

The three most widely read newspapers in Taiwan were chosen for this study. According to the survey by Nielsen Media Research, the three most widely read newspapers in 2008 were Apple Daily, Liberty Times, and United Daily News. The sampling period was from January 1, 2005 to December 31, 2009.

Based on literature review, 29 terms related global warming were used as search keywords which used "or" as a Boolean operator. The keyword searching was conducted from the electronic databases of the three newspaper companies. If the article lowly correlated with global warming, it was deleted. A total of 3653 articles were retrieved. These articles were sorted by their published date, and systematic sampling was applied to extract 15% as the sample.

Finally, 548 news reports were selected as samples for analysis of this study. Table 1 shows the published newspaper and year of the population and sample news reports. The Chi-square test results show that the amounts of reports from three newspapers are no significant difference between the population and the sample.

Of the total news reports, 57.7% (n=316) were featured in United Daily News; 27.6% (n=151) were in Liberty Times; and 14.8% (n=81) in Apple Daily. There is a significant increase in the amount of reports regarding global warming at 2007.

Table 1. The published newspaper and year of the news reports

	Newspaper						Totals	
	United Daily News		The Liberty Times		Apple Daily			
Year	N	n	N	n	N	n	N	n(%)
2005	183	28	112	15	75	12	370(10.1)	55(10)
2006	172	30	130	15	95	15	397(10.8)	60(10.9)
2007	556	80	382	58	153	25	1091(29.9)	163(29.7)
2008	504	82	169	21	122	17	795(21.8)	120(21.9)
2009	624	96	287	42	89	12	1000(27.4)	150(27.4)
Totals	2039	316	1080	151	534	81	3653	548
(%)	(55.8)	(57.7)	(29.6)	(27.6)	(14.6)	(14.8)	(100)	(100)

N: the number of news reports of the population.
n: the number of news reports of the sample.

Coding scheme

Each news report was coded for 6 variables.

Five issue categories were developed including global warming, climate change, environment policy, green industry, and green consumption. One news story may include one or more issues. The main topic and sub-topic were coded based on their weight in the story.

The source of news was coded. The category items included government or official institutions, academic institutions or experts and scholars, non-government organizations, private corporations, and other media or without sources. Reports that source of news unknown were classified under the fifth category. Location of sources of the news was coded as domestic or foreign.

Report style referred to the style of the report was published on the newspaper. It was divided into five categories including straight news, commentary, special theme report, op-ed, and translation reports.

The attribute of reports can be divided into six categories including composite report, policy story, knowledge story, research story, consumption story, and economic story.

When the report contained anti-warming information and was in an attempt to convince the audience, it can be analyzed for the appeal strategy. Category items included fear appeal, reward appeal, emotional appeal, rational appeal, authority appeal, and no appeal. One story may contained one or more appeal strategies. Only the main was coded.

Data analysis

Three coders were trained before analysis. The training involved 30 articles not used in the sample. The training articles were coded and discussed by all three coders until they felt comfortable with the coding scheme. Among all categories, the intercoder agreement ranged between 0.677 and 0.982. The whole intercoder agreement among three coders ranged between 0.847 and 0.868. The average intercoder agreement was 0.835, and the reliability was 0.938.

Results

Issues of news reporting

Of the total 548 news reports regarding global warming, 51.1% (n=280) concerned environment policy issue, 20.1% (n=110) concerned green industry issue mainly (Table 2). With respect to sub-topic, green consumption (34.1%) and global warming (33.8%) comprised the majority. It is worth noting that 10.2% of the stories only concerned an issue but did not implicate another related issue as sub-topic.

In one news story, the issues of main topic and sub-topic are presented on table 3. Environment policy most often appeared with green consumption (29.7%), followed by global warming with climate change (16.3%), then environment policy with green industry (13.2%), green industry with green consumption (13.0%), and followed, global warming with environment policy (12.0%). It is notable that climate change only appears often with global warming, but rarely with other issues.

Table 2. Main topic and sub-topic of the news reports

	Main topic	
Sub-topic Issues		n (%)
n (%) Environment policy	280 (51.1)	
17 (3.1) Green industry	110 (20.1)	
74 (13.5) Climate change	92 (16.8)	
29 (5.3) Green consumption	52 (9.7)	
187 (34.1) Global warming	13 (2.4)	
185 (33.8) No sub-topic	0(0)	
56 (10.2) Totals		548 (100)
548 (100)		

Table 3. The cross tab of multi-issues within one reports

Issues n(%)	Climate change	Environmental policy	Green industry	Green consumption
	80(16.3)	59(12.0)		
30(6.1)	23(4.7) Global warming			
18(3.7)	4(.8)	3(.6)	Climate change	
65(13.2)	146(29.7) Environmental policy			
64(13.0) Green industry				

Sources of news

Table 4 presents the details of the news coverage. Of the total, the largest percentage for source of news is government institution (32.3%), and the second is academic institution (23.7%), the sum of both comprise over half of the total. Global warming and climate change reports mostly came from academic institution (53.8%, 44.6%), environment policy reports mostly came from government institution (50.0%), while green industry news mostly came from private corporation (40.0%). There are 71.5% reports came from domestic sources totally. But climate change reports mostly came from foreign sources (58.7%).

Attribute of reports

Of the total, the majority of the attribute of reports is straight news (53.5%), follows by translation reports (25.7%). The percentages of op-ed (6.9%) and commentary (1.6%) are the lowest. Separate by issues, translation reports account for over half of the reports for global warming (61.5%) and climate change (51.1%). Reports on environment policy (61.4%), green industry (49.1%), and green consumption (64.2%) tend to be presented as straight news mostly.

Style of reports

Of the total, the majority of the styles of reports are composite report (29.0%) and policy story (29.0%). Reports on global warming and climate change are generally in research story (53.8%, 73.9%). Environment policy reports are primarily in policy story (50.0%) and composite reports (40.0%). Green industry reports generally appear in economic story (36.4%), and composite reports (20.0%), while green consumption reports generally appear in consumption story (35.8%) and composite reports (34.0%).

Table 4. Coverage of global warming relevant issues in newspapers

Category	Global warming n(%)	Climate change n(%)	Environment policy n(%)	Green industry n(%)	Green consumption n(%)	Totals n(%)
Source of news						
Government	1(7.7)	16(17.4)	140(50.0)	12(10.9)	8(15.1)	177(32.3)
Academic institution	7(53.8)	41(44.6)	49(17.5)	21(19.1)	12(22.6)	130(23.7)
Media	4(30.8)	21(22.8)	38(13.6)	29(26.4)	14(26.4)	106(19.3)
Private corporation	0(0)	2(2.2)	18(6.4)	44(40.0)	13(24.5)	77(14.1)
Non-government organization	1(7.7)	12(13.0)	35(12.5)	4(3.6)	6(11.3)	58(10.6)
Location of source						
Domestic source	8(61.5)	38(41.3)	219(78.2)	79(71.8)	48(90.6)	392(71.5)
Foreign source	5(38.5)	54(58.7)	61(21.8)	31(28.2)	5(9.4)	156(28.5)
Attribute of report						
Straight news	3(23.1)	30(32.6)	172(61.4)	54(49.1	34(64.2)	293(53.5)
Translation report	8(61.5)	47(51.1)	54(19.3)	27(24.5	5(9.4)	141(25.7)
Special report	1(7.7)	9(9.8)	16(5.7)	28(25.5	13(24.5)	67(12.2)
Op-ed	1(7.7)	5(5.4)	30(10.7)	1(.9)	1(1.9)	38(6.9)
Commentary	0(0)	1(1.1)	8(2.9)	0(0)	0(0)	9(1.6)
Style of report						
Composite report	1(7.7)	6(6.5)	112(40.0)	22(20.0)	18(34.0)	159(29.0)
Policy story	2(15.4)	5(5.4)	140(50.0)	9(8.2)	3(5.7)	159(29.0)
Research story	7(53.8)	68(73.9)	7(2.5)	6(5.5)	2(3.8)	90(16.4)
Consumption story	0(0)	6(6.5)	9(3.2)	18(16.4)	19(35.8)	52(9.5)
Economic story	0(0)	3(3.3)	7(2.5)	40(36.4)	0(0)	50(9.1)
Knowledge story	3(23.1)	4(4.3)	5(1.8)	15(13.6)	11(20.8)	38(6.9)
Appeal strategy						
Reward appeal	0(0)	0(0)	130(46.4)	54(49.1)	38(71.7)	222(40.5)
Rational appeal	7(53.8)	12(13.0)	70(25.0)	46(41.8)	11(20.8)	146(26.6)
Fear appeal	5(38.5)	75(81.5)	17(6.1)	4(3.6)	1(1.9)	102(18.6)
Authority appeal	1(7.7)	0(0)	55(19.6)	2(1.8)	2(3.8)	60(10.9)
Emotional appeal	0(0)	1(1.1)	6(2.1)	1(.9)	1(1.9)	9(1.6)
No appeal	0(0)	4(4.3)	2(.7)	3(2.7)	0(0)	9(1.6)

Appeal strategies

Among the news texts of this study, there are many appeal strategies used to convey the concept of anti- warming. On the whole, reward appeal holds the largest ratio, and emotional appeal is the least utilized. However, different topics utilize different appeal strategies. Global warming topics generally use the rational appeal, followed by fear appeal; climate change news generally uses fear appeal; environmental policy, green industry, and green consumption topics generally use the reward appeal followed by the rational appeal.

Discussion

From the perspective of learning, display the related concepts and their relationships simultaneously can assist in establishing conceptual connections for audiences. News reports concerned environment policy issue often

accompanied by green consumption issue. It shows that when news media deal with global warming issue, they tend to convert policy level information into personal level. The distance between policy and audience is long. However, consumption information implicates audience's personal actions. Mentioning environment policy and green consumption in the same news story is beneficial in helping audiences establish connections between policies and themselves. However, while "climate change" only appears often with "global warming" but rarely appears with another issues. Audiences can't establish connection between climate change and other related issues such as environmental policy, green industry, and green consumption through reading the news reports..

In terms of news source, most news stories on global warming and climate change were from academic institutions or experts and scholars, which indicate the cognitive characteristic of such science news. Approximately
30% of the total news and 50% of climate change news came from foreign sources. In addition, global warming and climate change reports are mostly translation reports. It shows that there is greater reliance on foreign media for these two issues. Global warming is an international issue. News from overseas can present the global climate change conditions and the developmental trends in fighting global warming in other nations. It is helpful in establishing an international perspective for this issue. But high frequency uses of translation reports may have a negative effect on the comprehensiveness and depth of domestic science news (Huang & Jian, 2006).

In terms of news attribute, op-ed and commentary account for less than 10%. Environment issues are not merely scientific, but are closely related to social domain. Environment policies especially demand exchanges of opinions from different departments of society in order to gradually form the consensus. News reports regarding global warming rarely appeared in commentary, meaning that the journalists in Taiwan may not engage in discussion such issues. The paucity of op-ed also means that the people participate less in such issues. In addition, it usually does not appear in special reports. Special reports are usually more breadth and depth, and are good to communicate the high density knowledge and complexity of science news. However, the low percentages of these types of news mentioned above should be improved upon in the future.

In order to motivate audience to engage in anti-warming, it may rely on the rise of environment consciousness and emotional love for the planet. However, this study discovers that only 4 news stories assumed an emotional appeal. In the future, the emotional appeal strategy can be used more.

Limitations

The analytical sample in this study was taken from the three most widely read newspapers. However, they do not represent all newspapers published in Taiwan. The samples were obtained through electronic database of newspapers; thus, the content was only textual, and without images and color. Electronic newspapers also have a different layout from paper newspapers. In addition, the characteristics of television, broadcasting, and newspapers are different, thus, the results of this study cannot be generalized to other news media.

Implications

The study findings suggest that when write global warming news reports, more related issues can be put in one story. It would help the audience establish connections between issues through reading. It is suggested that commentary and op-ed could be used more often to strengthen discourse on environment policy, and to achieve the communication with the public.

Future studies can deal with audiences, to explore how the public interprets news reports on environmental issues, and how reading news reports affects the audience's knowledge of, attitude toward, and behavior for anti-warming.

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321. NETA-Science: scientific knowledge without requiring the correctness --Implication from science boom in Japan

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Abstract. Recently there has been a boom in brain science among the public in Japan. Products promoting concepts such as "train your brain" or "condition your brain to adopt good habits" including books, toys, TV programs, and digital games, are very popular among the Japanese public. Although many Japanese neuroscientists have criticized this "boom", this trend has not slowed down.

In this presentation, we focus on the term Nou-Tore ("Brain Training"), the centerpiece of the boom in neuroscience, and investigate how the mass media treats the information about Nou-Tore, which neuroscientists regard as nonscientific. We found that information about Nou-Tore in the mass media included the scientific words. However, these scientific words were used in the non-scientific contexts, such as "care", "daily life" and "education", which was different from traditional scientific informationlike "care", "daily life", "education" etc. This indicates that the mass media use the word "brain training" for the primary purpose of serving as a news hook, not making much of scientific correctness. We refer to this type of attitude as "Neta-science"; "Neta" means a story or something buzzed about in Japanese. This is a new form of scientific information which is independent of conventional scientific disciplines which has a dualistic view of science/pseudoscience.

Discrimination of Neta-science from pseudoscience will give us a better understanding of the "brain boom" and the communication gap between neuroscientists and the public. Currently, many scientists criticize the "Brain training" as a pseudoscience. However, if we treat "Brain training" within the framework of true-false binary coding, we may fail to consider the attitude like Neta-science. Criticism on the basis of scientific inaccuracy just causes an answer such as, "It's not science at all, in this context, the primary importance of information is not scientific accuracy."

The concept of Neta-science will bring a new aspect in public communication of neuroscience. Considering the brain boom as Neta-science, it will take a positive role of diffusing neuroscience to the people who don't have much interest in science. Neta-science may satisfy what the people expect for science. Scientists and mass media should criticize Neta-science when, and only when, it leads to serious confusion and actual harm to individuals. As long as it is harmless, Neta-science can play a useful role in science communication.

322. Green Biotechnology and Genetically Modified Food: Perception and Attitudes of European Politicians and Journalists

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Abstract. With the world population reaching 9 billion in 2050, food production must increase until then by at least 50%. To face this challenge, scientists suggest using all tools available to increase agricultural productivity on existing land including advances in the field of genetically modified crops, food and green biotechnology. Still, previous research has shown skepticism by the general public and the political debate is even more than 15 years after the first introduction of genetically modified crops into Europe in full swing. However, little research has been conducted on opinion leaders and decision makers, such as politicians and journalists who are crucial for NGOs, scientists and industry to advance their agendas and/or products. With a quantitative research approach, attitudes, information sources and trust towards and perspectives for genetically modified crops, food and green biotechnology of European journalists and politicians in comparison to the general public are analyzed. Journalists and politicians proof to be much better informed, but are even more skeptic than the general public in many aspects. Significant differences, but also many similarities between the groups and subgroups could be observed and give impulses to the debate and its stakeholders.

Keywords: Biotechnology, Genetically modified food, genetically modified crops, Eurobarometer

323. Execution of Workshop Form Training Program for Science Communicators

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Abstract. National Museum of Emerging Science and Innovation (Miraikan) has concentrated on the practice of the science communicator's training and has developed some programs. Our programs can incorporate some kind of science communicators (SC), for instance, scientists science teachers postgraduates publicists of research laboratories and staffs of science museums etc. This paper introduces workshop form training program for SC, including some findings from its operations.

We developed and practiced the training program contained the following three features. (1) Short-term training; participants do not interrupt own works. (2) Participant who has various backgrounds; it is possible to discuss it by the diversified aspect based on practice. (3) The lecturers are Miraikan’s SC; the professional of the science communication advises. In addition, The SC's abilities are different according to their standpoints and purposes. Then we assumed three abilities, ‘Information coordination’ ‘Presentation’ ‘Facilitation’. First one is ability to scrutinize information and to add social value second one is expression ability to suit object and third one is ability to promote communications and to make a plan such an opportunity. Our program learns these three viewpoints.

As many as 525 people attended this program between 2005 and 2010. The pilot program had been done in 2005. Having been suggested from the pilot program the request of the participant was the lecturer's existence as the adviser who helped the environment that was able to carry out the discussion of the science communication and to discover the bud of the learning.

Then, we restructured the training program in the workshop form. For instance, one of the programs uses the newspaper article that is controversial one including scientific discovery and the last sentences have disappeared. The participant separates into a small group of about five people, and does three works. In the beginning, they look for ‘Social value’ from among the article. Next, the group imagines the appearance in the future that the scientific discovery written in the article brings. Finally, they bury the last sentences of the article. Their sense of values knocks against through these works each other. The participant deliberately does the discussion of the essence of the science communication repeatedly through the group work and the lecture. Our problem in the future is to measure whether there is continuance in the effect of the influence that training gave the participant. In addition, we should create the chance that they always improve the ability as a SC.

324. How Can Academic Professional Communities Contribute Public Relations of Science?

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Abstract. Developments of modern science have multiple aspects of contacting with societies and it arouses many conflicts with lay people. Scientific advancements are rather specialist or technical and are not friendly to be understood by lay people. Cutting edge scientific knowledge is produced by professional specialist belonging to academic institutes and nearly monopolized by them. These situations make the gap between science and public wider despite science nowadays become more powerful and influential to normal people's daily life. Science communications for sharing information on scientific advancements are becoming considerably important.

In 2000s, Japanese governments increase budgets for scientific research besides other outcomes were saved. Under this policy, many attempts for expanding the occasions of science communication have been done because of accountability for tax consuming. Academic institutes such as universities and national research institutes have crucial roles for that, they have extremely enlarged their public relations sections, and the press releases published by them were doubled. Short-termed research budgets program also played a big role for the expansion of science communication activities.

On another front, academic professional societies seemed to have not changed their activities much in comparison to academic institutes or some short-term research programs. Because they do not execute the research by themselves, and the research budget enlargement in the last decade could not make direct influence on them. But without abundant financial back-up, some academic communities have enhanced their activities on the contact points with public. Some academic societies have started science cafes, some started to publish press releases at each annual meeting, and some improved their outreach activities through their websites. Unfortunately, these activities' ameliorations were rather isolated, because interaction between other academic professional communities was not much active. Here I show an overview of Japanese academic professional activities on public understanding or engaging.

Public relation activities on science by academic professional communities have extreme importance. In Japan, most of the new coverage on novel scientific progress is based on the news releases issued by research institutes, not by academic communities. These releases are mainly addressed to mass media especially for newspapers which have specific sectors for science and technology, and the quantities of articles appeared on the newspapers sometimes have a power to persuade bureaucrats for researchers' activities to attain the budgets. Each public relation sections of research institutes have propensities for exaggeration about their own results, because they do not have responsibilities to the field of studies unlike academic professional communities. To enlarge the involvements of these communities on public relations of science make sounder situation.

325. Making the Most of Other Cultures–Attract People's Attention by "Blending Science": Case Studies in "Kitchen Science"

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Abstract. In these ten years, the importance of science communication has become recognized by governments and scientific communities. Many types of science events are being held every weekend, from lectures, symposium, workshops, public opening of research institutes, to science café, throughout the country, and most of them are organized by scientific institutes or groups related to science. These events attract people, but participants tend to become regular. These events' name are with scientific terms and speakers' name on the leaflets for publicities are only scientists ones. With these strategies, in spite of the flourish of multiple science communication attempts, public awareness and literacy for science are not seemed to be reacted.

There are people who have some interests in science without explosion and even self consciousness. For example, some people have some allergic feelings to the words related to science, but they can eagerly listen to the story with scientific explanation on some daily phenomenon. If approaches of science communication to these kinds of people are successful, public awareness and literacy of science can be improved.

We have planned and executed several noteworthy attempts to evoke sleeping interests in science by "lure-fishing" with cultures other than science. Scientific events like science cafes were planned featuring popular cartoon films, literatures and mythology, traditional performing arts or else. These events succeeded to collect different participants from other 'normal' science events. The names of other cultures worked like 'lure' in fishing. Such "fished" comers for science events seemed to be sometimes rather puzzled by scientific contents of the events, but some satisfied and evoked some interests to science.

We would like to introduce an example of the attempts as "Kitchen Science": the combination cooking and science. The science experiment classroom with cooking is effective for not only children but also parents for awareness of science. These events are successful in showing relation among public living and science & technology. The effective model working for attracting parent-child to science will be discussed.

326. Science Communication in an Applied R&D Institute

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Abstract. Public understanding of science is an important aspect that affects technology development and transfer in the modern society. An astute understanding of science by the public helps easy acceptance and transfer of technology. The relation between technology transfer and public understanding of science is much more intricate in case of public funded R&D organizations. In applied research organizations such as Central Food Technological Research Institute, Mysore, where the research being carried out relates to one of the basic needs and is associated with traditional practices. Not surprisingly, the technology transfer efforts in CFTRI encompass a wide array of public. From knowledgeable large scale processors to the cottage industrialists for whom the technology is tradition handed down through practice, the clientele of CFTRI varies widely. Accordingly, the Institute has adopted varied communication strategies to simulataneously address its clientele. The strategies have used an array of media. In the early days when nutrition awareness was a prime mandate, direct communication through lectures and demonstrations were in extensive use. Over the years as the literacy rate rose, the Institute used print media as a vehicle of communication. Besides press releases, Semi-technical and popular science publications in the form of pamphlets and handouts were published. The Institute also published Food Science, a Popular Science journal, unique in that it was dedicated to a specialized branch of science and was published at a time when general science journals were rare. The journal was published simultaneously in English and two Indian languages to cater to non-English literates. The paper will elaborate with examples on the direct communication strategies and the media approaches adopted for public engagement by the Institute.

327. Promoting Science Through Facebook: Characterization of an Audience and Interactions

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Abstract. The use of web-based platforms, such as Facebook, is increasingly widespread, amongst both individuals and organizations. New Media gives you the chance to potentially establish dialogue, build relationships and engage with the public.

Here we want to describe the use of Facebook by a research institute, Instituto Gulbenkian de Ciência, IGC. To our knowledge, IGC was the first research centre in Portugal to use this platform to communicate science, the researchers behind the science and events (scientific and science communication). With a presence at Facebook, IGC aimed to establish a steady flow of information to a wider audience and, furthermore, set a framework for interactive communication. In order to evaluate the impact of this communications strategy we conducted a study to characterize the audience at this platform and the interactions per post and per theme promoted through this media.

Our preliminary analysis extended over a six months period (from December 2009 to May 2010). As a first approach we analysed interactivity based on the use of "Like" button and number of comments. During this time frame 103 messages were posted on IGC Facebook page, which prompted a total of 707 interactions (57 comments and 600 "Like"). We further characterised the audience, when possible, i.e., when the individual profiles had information visible to others. We analysed the geographical location, profession, age and sex of the general "fan" audience and of the subgroup that interacted with IGC page.

We shall discuss our findings within the context of using Facebook as a medium for dialogue and discussion around scientific issues. Further challenges include involving scientists at the research centres in directly communicating their research through social networks. We hope in the future to extend this analysis to other research institutions that also use these platforms in order to analyse the promises and challenges of using social networks to raise awareness of science and promote dialogue.

328. From Public Awareness to Public Understanding of Science: A Model

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Abstract. Efforts to promote public understanding of science, in an attempt to address science knowledge deficits, have been criticised vehemently. It is maintained, even at this PCST conference for example, that an in depth knowledge about scientific principles is not necessary for the public to interact with science. Communicating science in ways that foster public awareness (i.e. "an appreciation of the way science works", as stated on the PCST website) is regarded, conversely, as a more realistic endeavour. The relative scopes of awareness versus understanding continue to be debated, where the latter is condemned, because it perpetuates a deficit model, and the former is allied to indefinite actions such as "participation" and "engagement".

Science communication literature suggests, however, a possible interplay between understanding and awareness. For example, the AEIOU vowel analogy (i.e. Awareness, Enjoyment, Interest, Opinion-forming and Understanding), defines understanding as a developed comprehension of scientific principles and what those principles imply commonly. In that context, awareness is regarded as a prerequisite for understanding. Another model, the Personal Awareness of Science and Technology (i.e. PAST), proposes that it is possible to change individuals' PAST through reflective experiences. It maintains that experiences which inform an individual's PAST, by connecting with previous experiences, can enhance that individual's scientific knowledge.

There is a lack of clarity, from a general science communication perspective, about the exact processes by which audiences progress from awareness to understanding. The roles of engagement and participation complemented by elements of ownership, belonging, enthusiasm and motivation, assume varied interpretations in different science communication models. This poster attempts to bridge this void by offering a model that describes the processes through which audiences' transit from being scientifically aware, to developing comprehensive understandings of science. Engagement, in this context, is defined as active participation where, desirably, both the communicator of scientific information and the audience contribute as well as receive. The ensuing co-production process leads originally to awareness and ultimately to a sustainable scientific knowledge-base, which this poster describes as understanding.

329. Science Communication through Geospatial Technologies and Mass Media in India

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Abstract. Science Communication through judicious use of geo-spatial technologies and mass media without following specific boundaries is an important concept for dissemination of scientific knowledge to the socio-economic wellbeing of society, although such concept is still an undeveloped field of study that requires a lot of further research and development.

In Indian conditions, where participatory democracy, plays a dominant role, such concept have high relevance. The sensible application of geospatial technologies and mass media in communication of scientific ideas and disseminating technological knowhow which shapes human life can go a long way in increasing human abilities to respond to technical issues and problems that pervade daily human lives. However, it would be desirable if, any national approach is compared with different other countries too, to understand, local, regional, national and global similarities and differences.

Geospatial technologies like mobile GIS and GPS, can trigger and sustain public interest in S&T, by playing important roles in situations such as disaster management that requires precise and reliable scientific information about the current situation on the tragedy mitigation of which needed urgent and sensitive spatial information i.e. location of the current state of calamity with in minimum waste of time and thereby allowing to manage it in a better way.

The present paper discusses various aspects of science communication through judicious use of geo-spatial technologies and mass media in Indian conditions. Since India is an emerging economy, its approaches indicate many new ways of thinking and putting ideas into practice, thus it is of much relevance to share such experiences and works with different cultures. The paper in hand also focuses on issues like scientific temper and review of studies covering public attitudes and cross-cultural mapping of public engagement of science.

330. A Study on the Correlation Between School Students' Creative Imagination and Their Personality and Peer Relationship

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Abstract. This study examined the correlation between school student's creative imagination and their personality and peer relationship. It assessed 70 students regarding their creative imagination and self report. Based on the findings of this study, it concluded that students' personality characteristics with more creative imagination are: (1) Like to work or play with others; (2) Usually have many ideas of interesting things to do for fun; (3) Enjoy drawing or painting; (4) Like to be first try something new; (5) Like singing or dancing with friends. Furthermore, peer relationship has an important impact upon the personality characteristics of the students with creative imagination.

331. Role of Tocklai's Science Exhibitions and Workshops in Educating Common People and Student Community on Health Benefits and Scientific Upbringing of Tea– A Case Study

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Abstract. Role of exhibition in educating and creating science awareness among student and common people is well recognized. It forms a platform where visitors get ample opportunity to express views and can exchange ideas with experts of relevant fields. Tocklai Experimental Station commonly known as Tocklai was established in the year 1911. Ever since its inception Tocklai promotes R & D in tea and has been serving Tea Industry of North East India and the contribution of Tocklai towards the growth of tea Industry of North East India is well documented. Tocklai has developed 185 new tea cultivars which have been widely used by planters. Agro-technology that have been evolved after a series of experiments are currently used by planters for scientific up upbringing of tea plants, pruning, plucking, manuring, pest control. Tea processing machineries developed by Tocklai are being used not only by planters in India but also used by planters of other tea growing countries of the world. Process optimization for quality tea production is an applied and practical science which has been accomplished with the establishment of model tea factory in 2004. Hosting of science exhibition is a tradition of Tocklai where all aspects of tea growing, tea manufacturing, tea tasting, pest control measures, identification of natural enemies of pests, including beautifully preserved butterflies of Tocklai museum, different grades of tea are displayed. Health benefits of tea are well displayed in the form of posters. Tocklai has also have a publication i.e official scientific journal,Annual Reports, Quarterly news letter, Tocklai news letter, Memorandum, Field management book etc for growers. Students from schools and colleges pay regular visits to Tocklai and interact with scientists, experts to know the basics of life science with special reference to tea. This paper evaluates a few national exhibitions attended by Tocklai and the knowledge that reached the tea grower, students and common people in respect of tea growing and its consumption.

332. Communicating Science with Respect for Water Culture: A Case Study on Thai and Laos Water Cultures

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Abstract. From the past till present, life styles of local communities, traditional characteristics and cultural landscape in the region of Thailand and Laos are water based and forming so-called 'Water Culture'. These water cultures are reflected in their local daily lives, proverbs, metaphors, rites, rituals and traditions. The researcher investigates the matter of cultural/ natural/ environmental conservation on the Science Communication perspective using documents, interviews and dialogues with communities. This study finds that Science Communication activities could be achieved with respect for Water Cultures of the region. Mutual learning enhances good relationship and profound understanding of Water Cultures of Thai and Laos people which show similarities and differences. Local Wisdom concerning Water Culture is actually operational or problem solving knowledge that keep local communities living in harmony with respect to one another and to nature as well as super natural beings. Strategically, it can be the foundation for natural and environmental conservation efforts amidst changes brought by modern development. New operational knowledge is derived from the co-creation between science & technology and local wisdom. Examples of such efforts are explained and shown in the poster session.

333. Science Communication as an Integral Part of Effective Research Management in Higher Education Institutions in South Africa

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Abstract. As a developing country, South Africa relies heavily on its higher education system to produce knowledge that can be applied to address the needs of its society. In its Research and Development Strategy (2003), the South African Government places emphasis on the important contribution the research has to improve the well-being of its people. Furthermore, research has an important contribution to make to evidence-based policy formulation in a developing country like South Africa.

This poster will show how science communication, as an integral part of effective research management in Higher Education Institutions (HEIs) can assist to create opportunities for researchers in South Africa to do relevant and applicable research that will have an impact on policy formation and contributes to the concept of science for society, while maintaining the academic imperatives of excellence and quality.

Public interest in science is growing in South Africa and the media can play an enormous role in showcasing the competitive edge of institutions. Although this function normally lies within marketing and communication divisions within universities, research management offices have to realize that to stay competitive and effectively support research activities, they have to not only provide up to date statistics and information on research outputs, for example, but they have to also play a role in disseminating research results to different stakeholders such as possible future collaborators, funders, postgraduate students and overseas investors.

It has therefore become more and more important for research managers to include in their strategy an element of science communication. Stellenbosch University, one of the leading research-driven universities in South Africa, is presented here as a case study to demonstrate how science communication, as part of a coherent research management strategy can provide new directions for the development of research and research-related activities. The poster will show how science communication feeds into the core elements of this strategy, namely (i) the introduction of strategic research themes; (ii) facilitating effective networking across disciplinary boundaries; (iii) research capacity building; (iv) maximizing research funding opportunities and (v) creative marketing.

334. Intellectual Property on Knowledge Based Content: Challenges to Science Communication

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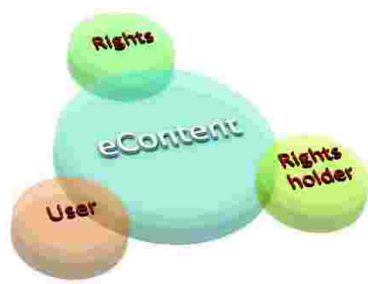
Abstract. The academic and research field is always under pressure because copyright is at the core of Intellectual Property (IP) and exist different opinions on the enforcement (or not) of rights owners on the new digital products. Educational institutions and educational publishers implement digital platforms to make the different educational content (eContent) available. These materials are made available through web content systems that implement the necessary access control mechanisms that give access to the platform or to content. This is the typical scenario. However, after the content has been released from the platform perimeter (after a successful access control authentication), the control over the content usage distribution and modification generally don't exist.

In academic field "fair use" - law that permits limited uses and reproduction of copyrighted materials without the owner's permission like use of a work for scientific or teaching purposes - is the current and commonly accepted doctrine but sometimes is misunderstood and author rights are not easily respected. Fair use is the safety valve of copyright because without it, copyrights foundational propose to promote learning, advance knowledge, and the progress of science would be useless.

eContent IP rights are also a property right which means the owner can assert to third parties it and transfer rights to others creating a complex layer of rights that sometimes could conflict. Relationships among them are depicted below:



At academic institutions the most basic right which most people wants to preserve is the right of attribution. And to preserve that when other people reuse content we must do one thing: references of the original author by citrating him. There are currently some technological measures that are able to enforce appropriate rights management mechanisms. However, these rights management measures are controversial and the application of these systems has to ponder the complex and contradictory pros and cons of such solutions. This usually results in two very different directions: the open access movement approach and the rights protection and management approach. In this paper, some eContent usage scenarios on science communication, eContent lifecycle steps and stages and some important issues concerning intellectual property like usage privacy and the factors that affect both of the above mentioned directions are presented. Also, the paper identifies, describes and discusses the implications and impact the usage of rights management solutions/technologies could have in some academic sectors that have an important role on science/knowledge communication like academic administrative activities, e-education and digital content libraries.

Keywords: Science communication, DRM technologies, Intellectual property of knowledge, IPR, security, ITC education

335. Green Alternatives for Malaria Control and Integrated Pest Management

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Abstract. The quest to make human less attractive to mosquitoes has fuelled decades of scientific research on mosquitoes behaviour and control. They interfere with the work and spoil hours of leisure time. Mosquitoes also transmit diseases such as malaria, filarisis and many other viral diseases like yellow fever, Japanese encephalitis etc. The strategies for reducing the mosquito borne diseases have been to pronged, centring around habitat control and the use of personal protection in the form of insect repellents.

Most commonly used synthetic mosquito repellent available in the market is based on DEET (N,N-diethyl- 3-methyl benzamide). Although synthetic repellents provide better protection against mosquito bites yet their toxicity, non-biodegradability, unpleasant odour etc., makes them less attractive compared to those of repellents from herbal origin. Various essential oils have been reported to have repellent activity against mosquitoes. Azadirachta Indica A. Juss., commonly known as neem in India, produces seeds which can be extracted to get neem seed oil (NSO). NSO has been used in various insecticidal and medicinal preparations. It can also be used for mosquito repellent purposes. Reports regarding the use of NSO as mosquito repellent are available in the literature. However, most of the studies addressed to the use of NSO in conjunction with coconut oil or mustard oil. There is enough scope to further work in this area. Controlled release by microencapulation is one of the way to improve further the effectivity of NSO as mosquito repellent.

Some entomologists now conclude that neem has such remarkable powers for controlling insects that it will usher in a new era in safe, natural pesticides. Extracts from its extremely bitter seeds and leaves may, in fact, be the ideal insecticides: they attack many pestiferous species; they seem to leave people, animals, and beneficial insects unharmed; they are biodegradable; and they appear unlikely to quickly lose their potency to a build up of genetic resistance in the pests. All in all, neem seems likely to provide nontoxic and long-lived replacements for some of today's most suspect synthetic pesticides.

The present review emphasizes on the potential efficacy of neem seed oil as an effective natural pesticide as well as mosquito repellent and larvicide and aims at to create awareness among the people towards greener alternatives.

336. A New Data Mining Model for Cancer Classification with Minimum Gene Features

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Abstract. In the past decade, bioinformatics has been a fast growing research field in health sector due to the advent of microarray technology. Amongst many active microarray researches, gene expression microarray classification has been a hot topic in recent years and attracted the attention of many researchers from different research fields such as data mining, machine learning, and statistics.

Gene expression data analysis plays a vital role in medical diagnosis and drug discovery. With huge volume of gene expression data, the possibilities of cancer classification have to be explored. Many methods have been proposed with promising results. Various statistical gene selection techniques, which are an integral pre-processing step for classification along with few supervised classification methods, were used in various works. The initiation of efficient classification algorithm for cancer gene expression data has been exploded in health sector during recent years. Particular application of Data mining algorithms for microarray technologies is in cancer research with a goal of early diagnosis of cancer. In machine learning community, supervised learning is to build predictive models using gene expression measurements of a number of individuals with known class membership.

This paper presents a new and novel supervised classification method for cancer classification and prediction. The proposed framework uses four stages in classifying and predicting future outcomes:

1. The first stage , pre-processing the database such as random division of the database for training and testing, noise removal, missing data estimation, individual feature(gene) ranking was proposed.
2. In the second stage all possible subsets of features were generated and ranking features pair wise.
3. In the third stage, all important gene pairs which achieved zero error in training using the best classifier were extracted.
4. Finally the fourth step classification and prediction. This work found to be efficient in reducing the number of genes that can best predict the type of cancer with reduced complexity and computational burden.

Keywords: Microarray, Classification, Prediction, Gene expression

337. Community Participation in Ecoschools for Sustainable Environment from Cuddalore District of Tamil Nadu, India

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Abstract. In these days of environmental crisis there is a need to increase people's sensitivity to and involvement in, finding solutions for environment and development problems. Education can give people the environmental and ethical awareness, attitudes and values, skills and behavior needed for sustainable development. Even though adequate concepts on environmental concerns have been incorporated in the textbook of all subjects right from first standard, teachers are unable to infuse effectively in their teaching learning process. As a result, the children are deprived of environmental ethics and consequently when they become adult citizens they resort to destructive activities on the environment. After realizing the need for promoting knowledge along with attitudes, values and skills among teachers and students on environmental concerns ecoschools have been established. The present study which was carried out by involving 120 members of the community from 10 of the 50 elementary ecoschools developed in Cuddalore district of Tamil Nadu from July 2008 to March 2009 focuses on the need for participation of members of the community in improving the performance of the ecoschools for sustainable environment. The knowledge, attitudes, practices, and performances of the members of the community were evaluated by administering tools namely "questionnaire",
"attitude scale", "application inventory" and "rating scale", respectively. The "questionnaire" and "attitude scale" consisted of 20 questions and statements, respectively under four dimensions namely "biology", "water resources", "pollution" and "hygiene and sanitation". The "application inventory" and "rating scale" comprised of four statements each. The grand mean knowledge score of the community recorded in the pre-test was 78.86%. The grand mean knowledge score registered in the post-test was 92.39%–an increase of 13.53 percentage points over the pre-test score. While the grand mean attitude score registered in the pre-test was 94.07%, the grand mean attitude score in the post-test was 4.14 percentage points higher than the pre-test score. The grand mean rating score recorded was only
36.87%. A wide variation among the various aspects of practices and performance was recorded. Even though the members of the community is known to possess higher level of knowledge about and attitude towards the environment the existing wide gap between the practices and performance needs to be narrowed down to enable them involve with more commitment in improving the physical environment of the schools and villages.

338. Spectroscopy in UV-VISand IR Region in Different Environment

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Abstract. Photophysical process is ubiquitous in nature, playing a key role in the light harvestingmachinery of photosynthesis, where hundreds of special antennae molecules are used to collect lightand transfer the absorbed energy towards reaction centers where charge separation occurs. Thiswork is an effort to explain the study of environment effects on the energy transfer. The study has its special interest on the use of different spectroscopic tools working in UV-VIS and IR region to identify intra/intermolecular charge transfer photophysics of different compounds which are active DNA bases which will be easily understandable to all.

Introduction

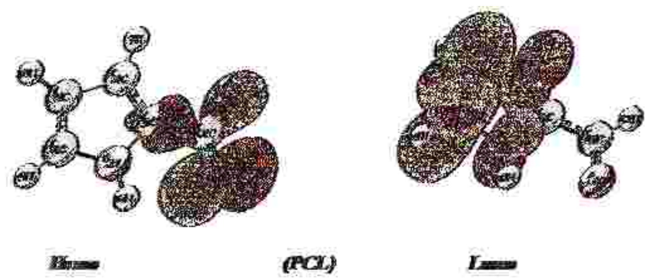
Among different hydrogen bonds, the O-H…O and N-H…O bonds most oftenoccur in liquid phase. It plays a crucial role in biological systems such as proteins and DNA basepairs and is essential for life processes. In all hydrogen bonded molecules there is a strongpossibility of solute and solvent interaction. There is a lot of studies deal with these interactions toexplain their nature, strength and other features important for physical, chemical, and biologicalprocesses such as proton transfer reaction, molecular association in solutions etc. Proton transferspectroscopy ground and excited state reaction dynamics of N-heterocyclic [1,2] is an interestingand developing subject area of research especially for the molecules containing more than one functional group.

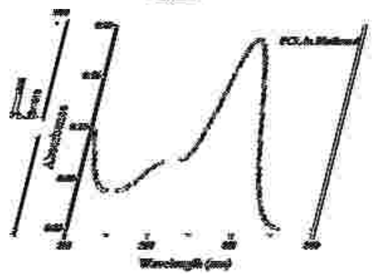
Methods

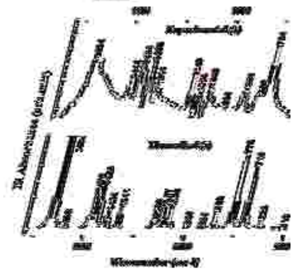
Absorption and emission spectrum in mid IR and uv-vis region reflects features of allmolecules as a whole. This fact suggests that the coupling of ab initio calculations [3] of vibrationalmodes and mid-IR spectroscopic measurements may be another powerful tool for studying the structural properties of Pyrrole-2-Carboxyldehyde
(PCL), Pyrrole-2-Carboxylic acid and its related compounds. The intramolecular redistribution of electronic charge due to photonicexcitation induces the ESIPT process which is ultrafast in nature [4].

Results & Discussion

The absorption spectra of PCA in different solvent point the presence of intramolecularly hydrogen bonded closed conformer in the form of 280 nm band. Stokes shiftedfluorescence of PCA at 310 nm in hydrocarbon solvent and hydroxylic solvents have been identified to be due to normal molecule. Variation of pH results enhancement or decrease ofemission from ionic conformer with parallel dwindling of emission of neutral species.Theoretical and experimental ground state and excited state behavior of PCLand its related compounds were investigated in UV- VIS and mid IR region of electromagneticspectrum. We have measured the spectrum of PCL in the UV-VIS region ranging from 190 nm to 900 nm and in IR region ranging from 450 cm-1 to 4400 cm-1. Possible origins of dominant absorptionbands have been assigned successfully with ab ignition HF and DFT calculations taking the effectsof hydrogen bonds in account in the IR region. Possibility of intramolecular and intermolecular hydrogen bonding of PCL in ground state was established theoretically by the distance N5-H6………O11 of acidic and basic moieties of PCL and experimentally it is verified by the IR stretching and bending mode vibrations of different parts of the molecule
[5]. The possibility oftransfer of hydrogen from pyrrole ring towards formyl ring in excited state indicates in the light of difference in bond length and bond angle, dipole moment, enthalpy, Gibbs free energy etc and with fluorescence and phosphorescence spectrum in the excited state of the molecule. The absorption maximum and oscillator strength computed from HF (RHF, UHF), DFT calculations for gas phase, nonpolar medium, polar medium agrees reasonably well with experimentally measured data. We consider that the experimental and theoretical results presented here are useful for studying theelectronic and vibrational properties of different olefins.







UV-VIS absorption spectra of PCL in MeOH. *IR absorption spectra of PCL in KBr pellets.*

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339. Relations of Food Habits and Skin Diseases: Eczema

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Eczema is a broad clinical term that embraces number of pathological different conditions characterized by red, papulovescicular; oozing and crusted lesions at early stage and with persistence eventuate into raised, scaling plaques. Eczema has acute phase, which if untreated goes into chronic eruptions, histipathological features are same of all these conditions but clinically we can classify into following categories as:

- Atopic dermatitis
- Allergic contact and irritant contact dermatitis
- Dyshidrotic eczema
- Nummular eczema
- Lichen simplex chronicus
- Asteatotic eczema
- Seborrheic eczema

Thus primary lesions may include papules, erythematous macules and vesicles, which can coalesce to form patches and plaques. In severe eczema secondary lesions from infection or excoriation marked by weeping and crusting may predominate. Long standing dermatitis is often dry and is characterized by thickened, scaling skin that is also called as linchenification of skin (Acanthosis).

Atopic eczema: It is cutaneous expression of atopic state. It is characterized by family history of asthma, hay fever, or dermatitis in up to 70% of patients. It is usually polymorphous on body site sharply defined scaly plaques with or without inflammation, which may be associated with hair loss. It is prevalent mostly in Norwegian children up to 23%. There is clear genetic predisposition. If both parents are affected, then over 80% of their children manifest the disease. When only one of the parents is affected, then 50% of children get disease. These patients display variety of immunoregulatory abnormalities like increased IgE synthesis, increased specific IgE to foods, aeroallergens, bacteria and bacterial products. The atopic eczema characterized by weeping inflammatory patches and crusted plaques that occur on face, back of neck, extensor surfaces of extremities, groin. In adults pattern is usually seen as localized type. Pruritus is predominant characteristic of atopic eczema. Usually findings are secondary to rubbing or scratching. Present therapy approves treatment with anti-histaminic, anti-pruritic drugs, systemic steroids, local steroids are freely advocated. It is very difficult to detect allergen in particular patient, because of which treating him becomes difficult with present anti-eczematous treatment. Still it has not succeeded in curing atopic eczema definitely.

Contact dermatitis: It is an inflammatory process caused by exogenous agent or agent that directly or indirectly injures skin. If the injury is caused by inherent characteristic of compound, it is called as allergic contact dermatitis. Phytodermatitis or plant dermatitis examples are Rhus family plants, Ivy poison, Oak poison, Sumac etc. If irritating agent causes the injury, it is called as Irritant contact dermatitis. Examples are acid contact of skin, silk cloths, and foam leather footwear's etc. So in ACD if offending agent is identified, confirmed and removed, irruption will resolve. Identification of allergen is difficult. Treatment is based on application of topical medicaments and oral medications. Common sensitizers like nickel Sulphate, potassium dichromate, thimerosal in ocular preparations, neomycin Sulphate, fragrances, formaldehyde and rubber-curing agents are used. Systemic steroids are used freely to treat ACD. Treating infection, use of topical glucocorticoids, cool moist compressors plays no role in treating disease entity. However all these treatments have their limitations?

Nummular eczema: It is characterized by circular or oval eruption, consists of edematous papules that become crusted and scaly predominantly seen over trunk, extensor surfaces of extremities or dorsum of hands and legs. It is also known as Tinea Pedis. Treatment is like above mentioned, but still it has its limitations.

Lichen simplex chronicus: It represents end stage of pruritic and eczematous disorders. It consists of well-circumscribed plaques with Linchenified or thickened skin due to chronic scratching or rubbing. Treatment is to break chronic itching that mainly occurs at sleep. High potency topical glucocorticoids along with antihistamines (hydroxyzine, tricyclic antidepressants-doxepin etc.) are mainly used to treat this disorder. Still all these treatment has its limitations.

Asteatotic eczema: It is known as xerotic eczema or winter eczema is mildly inflammatory dermatitis seen over lower 1/3 of both legs. Fine cracks with or without erythema develop on anterior surfaces of lower extremities. It responds to avoidance of irritants, rehydration of skin, and application of topical emollients. But it has its limitations.

Stasis dermatitis: It develops on lower extremities secondary to venous incompetence and chronic edema. Typically involves medial aspect of ankles. As dermatitis progresses, skin becomes progressively pigmented due to chronic erythrocyte extravasations leading to cutaneous hemosiderin deposition. Chronic stasis dermatitis is associated with fibrosis, known as brawny edema of the skin. It is complicated by infection and contact dermatitis. Severe stasis dermatitis may cause stasis ulcers. Treatment has limitation and use of topical applications and compression stockings with 30mm of Hg pressure are beneficial to certain extent. Also elevation of affected foot while sitting or in sleep helps in decreasing edema. However it has also its limitations. Surgical intervention by plastic surgery is best treatment.

Seborrheic eczema: It is a chronic common disorder characterized by greasy scales overlying erythematous patches or plaques. It is prominently seen on scalp and it also called as dandruff. It is also seen on eyebrows, eyelids, labella, nasolabial fold or ears. Treatment is use of low potency glucocorticoids along with shampoo. But it has its limitations; because it does not give easy feeling (sensation) to patients and patients repeatedly feels to scratch his scalp.

Pathogenecity: In acute stage, there is formation of red, papulovescicular, oozing, crusted lesion. These lesions are prone for super infection. And itching its characteristic worsens this disease process. As time lapses, lesion becomes dry and skin starts becoming Hyper keratinized.

Eczema is a chronic granulomatous skin disorder (CGD) affects skin as well as lung, lymph nodes, liver, bones. Chronic Granulomatous Disorder is characterized by impaired host defense against microorganisms. Immunoglobulin levels may be elevated or normal. Delayed hypersensitivity is impaired. Leucocytosis with increase in proportion of neutrophils is characteristic of CGD. Neutrophils do not kill those microorganisms generally found in the lesion, but kills staphylococci, lactobacilli, pneumococci. Microbicidal defect is mainly due to decrease in Phagocytosis, which eventually induce metabolic burst. So decrease in oxygen supply, H2O2 deficiency and bacterial & fungal resistance to existent available drugs are main causes of this disease process. It can be revealed by presence of microorganisms, fungi, biopsy, Leucocytosis, raised neutrophils count. Others like KOH preparation, Tzanck smear, Diascopy, Patch test is useful in diagnosis of this entity. Thus decrease in oxygen supply and decrease in hydrogen peroxide in subcutaneous tissue are main cause of decrease in Phagocytosis. Staphylococcus aureus, certain gram- negative bacteria, fungi are predominant pathogens. As neutrophils fail to kill all microorganisms and there is influx of polymorphonuclear leucocytes with abscess formation, which is a feature, with central necrosis, surrounded by numerous plasma cells, lymphocytes, macrophages characterized by yellow lipid material. Diagnosis can be done by increase in neutrophils count and presence of microorganisms.

Microbiological explanation: The main characteristic of acute eczematous lesion is accumulation of edema fluid in epidermis (spongiosis). In urticaria edema is localized to perivascular spaces of superficial epidermis. In spongiotic dermatitis edema seeps down to intracellular spaces of epidermis, splaying apart keratinocytes located primarily in stratum spongiosum. Thus intracellular bridges become prominent giving spongy appearance to epidermis. So mechanical shearing of intracellular spaces and cell membrane progressively accumulates fluid in formation of intraepidermal vesicles. Therefore during earliest stages of spongiotic dermatitis, there is superficial perivascular lymphocytic infiltrates associated with papillary dermal edema and mast cell deregulations. Thus spongiotic dermatitis resulting from drugs (Sulpha drugs, Chlorpropamide, Methyldopa, Ampicillin, Amoxycillin, Oral contraceptives, Penicillin, Tetracycline, Chloroquine, Phenylbutazone, Proxyvon-group of drugs) will show lymphocytic infiltrates often containing eosinophils and extends around superficial and deep vessels and as the time passes spongiotic dermatitis may subside giving rise to progressive epidermal hyperplasia with hyperkeratosis and parakeratosis.

Facts as patients reciprocate to anti-eczematous treatment: As we think of eczematous skin disease, a picture of person scratching his skin is usually seen. People never take this disease very seriously at least in India, unless it harms their daily routine work. This confirms that attitude and approach of patients to get cure from this skin disease is very minimal. The main cause of avoiding to take treatment for eczema is failure of any method of treating disease entity to cure this chronic eczematous skin disease process. So this eczema is also called as neglected disease by society. This is mainly because of failure of drugs to cure this disease process. The failure is mainly due to:

- Drug resistance
- Cutaneous atrophy
- Incurable itching
- Inability to enhance Phagocytosis

It means inability to kill all pathogens causing this disease. Also all these eczemas are tension related. Thus present anti-eczematous drug fail to bring an end to pathogenecity of chronic eczematous skin disease process. Basically staphylococcus aureus and certain gram-negative bacteria along with certain fungi are strongly resistant to available allopathic anti-eczematous skin disease process. Now facts regarding my invented Yashoderm are given underneath:

- The process of mixture is meant for external use only.
- The solvent in this process is universal solvent (water).
- The process according to the claim wherein the reaction is carried out in solvent within skin layers is inert under reaction condition.
- As per claim this reaction is carried out at any room (atmospheric) temperature.
- The process according to the claim wherein reactants formed are nascent oxygen, hydrogen peroxide along with excess of chlorine and excess of hydrochloric acid formed plays major role in enhancing phagocytosis.
- As per claim the composition of chemicals have good physical and chemical stability.

Goals or objects of my invention: -

- First stop chronic itching.
- Demolish Linchenified (Hyperkeratotic [Acanthosis]) and make the skin totally normal by medication only and ultimately remove ugliness of skin.
- It must be affordable to any patient.
- To find ultimate remedy to cure any type of eczema.
- Patient must get cured in shortest duration of period without inducing extra tension of regularity of taking number of drugs to these patients.
- Cures dandruff (Seborrheic eczema) most effectively.

The said process is only for external use and solvent used is water. The drug must be kept in non-humid place, out of reach of children. The said process composition must be kept in dark tan glass bottle or thick black plastic container with tight cover and drying agent (dehydrating agent) like silica gel rapped in polyethylene bag (synthetic paper) or cotton bag is kept in a special socket made from inside of cap or cover having holes at its bottom to absorb water molecules present in container.

Before bathing and / or at night before sleeping appropriate quantity of mixture (1 to 1.5 grams) is taken in saucer or glass container. Never use stainless steel vessel, because drug reacts with the same and stainless steel vessel will get spoiled (damaged). Then wet eczema skin with water, so drug must be applied on wet skin only. Then add at least ten milliliters of water to drug taken in saucer. As we add water to drug, all active ingredients get dissolved in water and what remains behind is residue of calcium hydroxide. So mix it with hand only and immediately apply prepared liquid drug by hand only on eczema skin and rub area with ordinary stone or turf of coconut hair by applying tolerable pressure for two minutes. This process of rubbing must be delicately done most seriously, because the active ingredients of drug get percolated deep in to the skin and there by kills all microorganisms and fungi present in that area causing this chronic eczematous skin disease process most effectively. Then wash skin with fresh water. So simple is my procedure. Then immediately bathe yourself and you can use any soap for bathing; but after bathing, not a single particle of drug should remain on skin. If it exists, wipe it under running water or clean with wet cotton. All eczema patients must reduce use of soap unnecessarily quite often in a day, because saprophytic bacteria present on skin that protects skin from exogenous agent like bacteria or fungi.

In the above described process, to get synergistic effect, one can give injection of triamcinolone acetonide intramuscularly once in a month. This way the patient gets cured of their disease very fast. In the above-described process reactants formed are utmost essential to enhance phagocytosis in eczema. These reactants get percolated in dermal layers and stops itching, removes acanthotic skin, kills all microorganisms and fungi by its highly potent action and by correcting leukocyte metabolic activity; ultimately cures chronic eczematous skin disease process. The excess of active agent forms plays subordinate role in removing or abolishing linchenified skin of eczema and finally brings an end to chronic eczematous skin disease process.

Psoriasis is very obstinate, obscure chronic skin disease seen in human beings. There are eight types of psoriasis. They are as follows:

i. Plaque psoriasis: It is most prevalent form of disorder characterized by raised inflamed scaly lesions. Dead skin cells form scales while inflammation is result of increased blood supply to areas of rapid cell production.

ii. Pustular psoriasis: It is characterized by pustules on skin. It has three distinct phases as reddening of skin, formation of pustules and scaling of skin.

iii. Guttate psoriasis: It produces small red-drop like lesions accompanied by scaling. It can be triggered by strep's throat or upper respiratory infections, chicken pox, physical trauma, illness by anti-malarial drugs.

iv. Inverse psoriasis: It mainly affects skin folds characterized by smooth red inflamed lesion without scaling often irritated by rubbing or by sweat.

v. Erythrodermic psoriasis: It is characterized by inflammation all over body with swelling, pain and itching.

vi. Scalp psoriasis: About half of psoriasis has scalp psoriasis characterized by heavy scaly skin with itching irritated by sweat or irritation.

vii. Nail psoriasis: It mainly affects toe nails. Nails become thick, pitted and often yellowish in color.

viii. Psoriasis arthritis: it causes inflammation and swelling of finger's joints, feet, knees, hips, elbows. About 10% of psoriatic patients develop psoriatic arthritis.

Psoriatic patient must avoid following food articles.

1. Fruits: Mango, Banana, Chikoo, Papaya, Pine apples, Jackfruits
2. Diet: Strictly abandon non-vegetarian food products of any kind
3. Munching items: Abstain Nagali's or Udid's papad if they are made with papadkhar (a type of salt). If one prepares Nagali's and Udid's papad without making use of papadkhar; it can be indulged. Rice papad is allowed to indulge. Abstain Mango pickle but you can eat lime, chilly and myrobalan pickles. One can eat potato chips, Sago papad, Chakali made out of Sago and potato mixture with chilly powder, garlic. Wheat's kurdai can be indulged. However any oil-fried products must have very limitations.
4. Habits: No habits are allowed. Patient must be non-habitant.
5. Oils: Groundnut oil or use of complete groundnut or crushed groundnut in vegetables or any food products must be avoided. Person can use sunflower oil, soybean's oil, safflower oil or palm oil for preparing food.
6. Masala: Garam Masala is not allowed. Person can prepare all foods in red chilly powder only. One can eat green or red chilly.
7. Vegetables: brinjals, cluster beans, drumsticks, coriander leaves or coriander, ginger must be abstained.
8. Milk and its products: Any plain milk without cream must be indulged. Cream is abstained. Milk sweets are allowed but curd, buttermilk, sugar added buttermilk, kadhi, shrikhand are not allowed. Ice-cream prepared from custard powder, milk, sugar but without cream can be indulged. Ice-cream with cream is not allowed.
9. Nuts: gram nut and its all food products must be avoided. We prepare pithle, dhokale, bhaji, potato wada (one can eat potato but potato wada must be avoided), we soak gram nut, mung and math in water. Then we tie the same in simple cotton cloth for one day. It germinates and then we prepare vegetable out of the same. So math, mung can be indulged but gram nut must be avoided, we prepare wade's vegetable, puranpoli, shev, chivda, farsan, fafada, bundi's ladu, mysore-pak cake, kate-shev, chana-batura.all these products are made out of gram nut. So they must be avoided. Use of white udad nut must be restricted.
10. Salt: Never eat excess of salt. Whatever salt is added while preparing food can be indulged. Some people have habit of eating excess of salt, which is not allowed.
11. Soap: Use of soap is not allowed. One must bathe with shikakai, utana or bajara's floor. Psoriatic patients must avoid washing clothes. Contact with any type of soap is not allowed. Women must use disposable napkins when they are having periods (menses). Also men must shave without use of cream. Just apply Luke-warm water over beard area and have shave. After-shave spray or liquid are not allowed. Alum or dettol can be used to wipe bearded area.
12. Cosmetics: Scents, perfumes are not allowed. One can use face powder, talc powder, no nail polish. Please no bleaching of face or facial procedures.
13. Dry fruits: Most of dry fruits must be avoided. Even dry coconut is not to be indulged. Cashew, clove, cinnamon, almond, walnut, a date, a dried date, godambi, coriander nut must be absolutely avoided. Fennel, a currant (dry grapes), charoli cab be indulged.
14. Bakery products: Toast, soft bread, ban can be indulged. No other bakery products are allowed. Ordinary glucose, Marie biscuits can be indulged. Cream-biscuits are not allowed. All cold-drinks can be indulged. Mixed-fruit jam can be indulged at times.
15. Miscellaneous: Magi noodles, Chinese noodles in red chilly can be indulged. One can make use of any sauce, chatnies without crushed groundnut. Certain allopathic drugs are promptly avoided in these patients.

They are as follows:

a. Avoided quinine group of drugs like Chloroquine, primaquine and quinine.
b. Avoid Proxyvon group of drugs like spamoproxyvon and butaproxyvon.
c. Avoid Ibuprofen group of drugs like combiflam, anaflam etc.

d. Avoid chlorpromazine and other sedatives. e. Avoid all anti-arthritic drugs.
f. Avoid salicilates like disprin, lithium carbonate, iodides, nystatin, and anti-hypertensive beta-blockers. g. Avoid sulpha drugs.

All the above mentioned factors disable equilibrium of human body. In our body every organ has fixed Ph. The whole body is maintained normally at equilibrium. If acidity of body increases, person is likely to get intracranial haemorrhage, strokes, infarcts, ischemic heart diseases. If the basicity of body increases person's immune response goes down (ability to fight against different diseases) and atmospheric bacteria, fungi or viruses attack on body and patient becomes sick due to infectious diseases. I have developed Suswasthya Churna that brings body to equilibrium and person becomes normal. Its outstanding properties are given underneath:

i. It is best drug against acidity (acid-peptic diseases {APD}), Chronic constipation, has ability to stop most abnormal activities of our body.
ii. Promptly helps in reducing weight by dissolving excess of accumulated body fat.
iii. At puberty, there are hormonal changes and most of people become victim of acne and body heat. My Suswasthya Churna corrects and cures acne by destroying harmful effects of changes that had affected body due to hormonal changes at puberty.

iv. Suswasthya Churna affects human Psychology and most of these patient feels comfortable due to loss of lethargy, uneasiness, easy fatigability. People indulging Suswasthya Churna will certainly feel fresh, normal and tidy.
v. It has been experienced by regular follow-up study in more than one thousand cases that, it has no side- effects at all and helps in curing all chronic skin disorders, chronic APD, chronic constipation, UTI. It has also been found beneficial in people suffering from chronic arthritis. I recommend its use by every person suffering with chronic disorders. It does not have any side effects and it is always helpful in some ways to distorted body.

340. Science Communication for the Rural People: A Survey

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Abstract. More than 70% of India`s population resides in rural areas. Majority of rural population in India carries out subsistence farming. The average rural Indian farmer is either illiterate or semi-literate, and if literate, even then cant communicate in English. Latest and advanced information related to market prices, weather forecasts, quality of land, pests control and crop management is vital for professional growth of farmers. Most small scale farmers are dependent on mediators for agro-based information and lack direct and immediate access to it, due to lack of infrastructure and low income.

In our present work, we conducted a survey of farmers and found that farmers often get swindled or misled because of dependency on some malicious and pretentious mediators. They do not have access to the internet, however communication means like radio, television and mobile phones have widely penetrated the rural areas. From our analysis, we analyzed certain prerequisites that are essential for effective information channel for the farmers. The details will be presented in the presentation.

341. Need of Comprehensive Approach to Trained Science Journalist

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Abstract. The question of how science engages publics is becoming important everywhere in the world. With the spread of mobile and Internet technology, the growing food crisis, the threat of global warming, the expansion of medical research sites, the development of genetically modified crops, and the challenges of particular diseases and health care. As one way of making the widespread implementation of innovations possible, new information technologies are reshaping the nature of knowledge mobilization, hence public engagement with science and the engagement of publics by science, is becoming increasingly important. The dissemination of knowledge demands special skills and keen interest in science and related topics, therefore the role of science journalists, trained and skilled becomes very important. At the journalism schools and news organizations, the development of new “modern science and technology” beat should be encouraged. This will fill in the gap between the technical backgrounders preferred by the science writers and the conflict emphasis of political reporters; it will provide important background for debates on science policy. A trained science journalist can assist in raising awareness of the role of science in society.

Keywords: Public engagement, Dissemination, Trained, Skilled, Modern science technology

342. Constructive Framework for Effective Science Communication

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Abstract. It is fundamental that feed-back be given to any communication and the effectiveness be analyzed. Important perception of science communication is that the information is exchanged in order to share the information. Based on effective science communication, present investigation focuses on the research on instructional effectiveness of science teaching apart from traditional methods. Great amount of learning materials through multimedia instructional system can be reused by many individuals, providing that there exists an effective way of finding and disseminating this material. A new concept, a unit of learning materials in a multimedia format, has been developed to ensure that learning materials are thought provoking and reusable replacing the reportedly unacceptable traditional method of teaching in the subjects of science.

The research addresses likelihood and effectiveness of developing learning materials for science education into an adaptive learning system. The research is a systematic approach towards learning facilitation with enhanced enthusiasm, an attempt to establish an agreed method of formal and informal environmental education as well. The investigation analyzes comparison of the students' perceptions towards difficulty levels experienced during the traditional method of education. We have extended multimedia based learning tool as learning objects to teach students with an individual adaptive learning experience. We have evaluated the tool confirming its effectiveness and acceptability for students learning. The innovative approach is found to strengthen effective exchanges between the pupils and teachers providing leadership and practical know how to the concept of sustainable development. It also corroborates voluntary participation, seldom seen in traditional methods of teaching-learning system. Statistically analyzed data indicates that the innovatively designed multimedia system of instruction is reportedly acceptable, inviting voluntary participation of the pupils, palatable and deepens understanding the concepts to a greater depth, and facilitates distance education and in-service teacher training objectives. The multimedia-learning, a new approach to education has proved to invite voluntary participation.

Keywords: Adaptive learning system, effective communication, learning facilitation.

Introduction

An integrated process for environmental education through multimedia instructional system has not been incorporated yet in the educational scenario yet across the country. Although environmental education has been introduced into many curricula, this is only a beginning step. The incorporation of instructional system is hopefully to play a crucial role in deepening the understanding of the environmental education among the pupils and is required to set ourselves on fruitful sustainable paths. Most instructors want to make the classroom a place where students are encouraged to test ideas, make connections among subjects and content areas, explore problems and issues, work cooperatively, and become lifelong learners. They believe that students must be intellectually engaged and actively involved in their learning, and that traditional instruction is likely failing to provide this engagement. Tremendous efforts have been made by educators to help students learn. Peer group and collaborative learning have been introduced into classrooms. Collaborative learning promotes communication of ideas and understanding of concepts. In view of implementation and investigating the efficacy of the method of collaborative learning "Multimedia instructional system" was developed for environmental education to study its efficacy in the teaching learning process, an innovative education process for sustainable community development and it has been experienced with reinventing the concepts of education and development.

The approach has observed to have broad implications in the education process. The main objective of this study was to examine the practicability of multimedia instructional system for an education process, which is expected to contribute to easing the educational process that in turn contributes to a sustainable community development as exemplified by the research output. The participatory research data has been used to extend theoretical perspectives on applications of multimedia instructional system and environmental education and to reinforce new directions of research on education and sustainable communities. The research focuses on designing instructional systems, its efficacy in processes in learning and instruction, delivery systems and evaluation of instruction in the context of Environmental Education.

Methods of study/design of study

The standard systems view of instructional design is depicted as under:

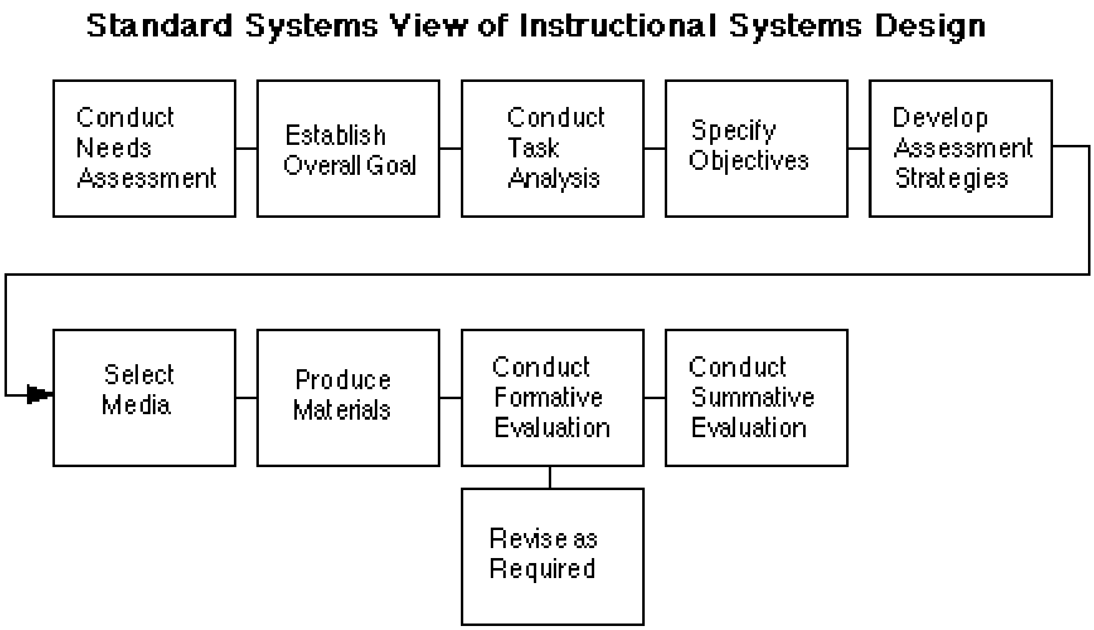

Fig 1. Standard Systems view of instructional Systems Design

Table 1. Gender attitude or performance towards investigative parameters

INVESTIGATIVE PARAMETERS	GENDER ATTITUDE OR PERFORMANCE		AVERAGE
	% MALES	% FEMALES	
Performance Grade	68 (B)	74 (B)	71
Inclination towards traditional Black-Board methodology	76	80	78
Inclination towards Technology integrated classroom environment	91	89	90
Inclination towards combination of Technology integrated classroom environment with traditional methodologies	83	92	88

n Males = 83, n Females = 79

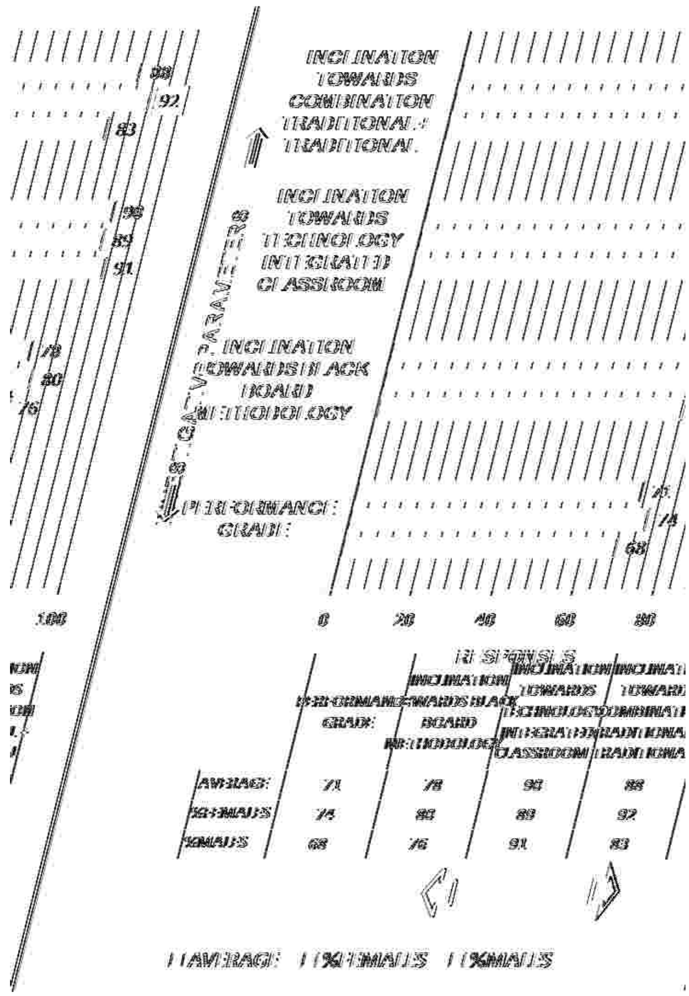

Figure 1; ***Graphical illustration of Gender attitude or performance towards investigative parameters***

The design of the study includes a sequencial flow chart of the system involved as; Conduct needs assessment, establish overall goal, conduct task analysis, specify objectives, develop assessment strategies, select media, produce materials, conduct formative evaluation, conduct summative evaluation, revise as or if required. The design further had an investigatory intention ;-

1. To analyze the conventional approach of teaching Environmental Education.
2. To plan multimedia instructional system for Environmental Education.
3. To design and construct multimedia instructional system for Environmental Education.
4. To test the effectiveness of constructed multimedia instructional system.
5. To compare the effectiveness of constructed multimedia instructional system with the conventional system of instruction.
6. To validate multimedia instructional system in terms of their effectiveness over conventional system of instruction.
7. To equip the pupil teachers and teacher-educators with reliable system to overcome the difficulties in theory course of Environmental Education instruction.

The above investigation was performed under traditional classroom environmental settings that investigated the relationships between student performance in introductory method of curriculum delivery, various educational characteristics, learning preferences, and the potential effectiveness of technology as a medium of instruction to complement face to face teaching. The survey consisted of the student consent form along with the three levels of instrumentation which were developed to collect quantitative and qualitative data for this study. It could be administered quickly in the large introductory class.

Results and Discussions

The investigations resulted in elevating pupils interests in curricular studies a sign of development of a positive attitude towards science is one of the most important goals of the curriculum as also observed by Koballa and Crawley, Laforgia, (1988). Activity-based joyful learning approach as an emerging trend in the field of teaching methodology/ strategy, is important for our school education as reported by Panda & Basantia 2004). Lewin and Potter (1947) reported that children get answers to questions by finding out their own routes to discovery.

Investigations proved effective to reduce the dimensionality of the learning items of the learning perception survey to more basic variables based on the responses received from the participants. Based on the nature of the statement items and Bloom's Taxonomy of the cognitive domains, these six factors were named individually as Learning By Rote (Factor I), Learning By Relating (Factor II), Learning by Comprehension (Factor III), Learning Through Formula Derivations (Factor IV), Learning Through Effort (Factor V), and Learning Through Practice (Factor VI). Further, the results of the evaluation of the students' performance were based upon their semester long grades on exams and homework assignments. Overall, 68 percent of male and 74 percent of female participants received a final grade of B or higher (Table 1). No significant performance differences were found between male and female students
(Fig. 1). This study found that participants performed better by trying to understand the learning material and relate problems to real world situations. Participants who relied on rote learning did not perform well. It was reported that computer-supported and interactive learning environments better serve the diversity of students. Results from the qualitative method at this study showed that a majority of students were on the whole positively inclined to having the pedagogy with the integration of educational technology, such as PowerPoint presentation, visualization, simulation, and found it helpful in learning. The results were also positive about advantages gained from the use of Black Board and interactive communications such as asynchronous discussion. About 90% of students in the technology-integrated classrooms reported being benefited by the learning environment while 78% of students in the traditional classroom setting indicated their preference in having the technology-integrated curriculum. Further, the student performance in the technology-integrated classrooms indicated that 90 percent of the technology-inclined participants compared to 78 percent of the black board methodology (Table 1).

The student performance technology inclined participants as compared to the traditional lecture-format classroom showed progress and were satisfied with the current technology integrated classroom instruction format. In this study, however, no significant gender difference was found between students who favored the integration of the technology in the introductory design and students who favored to learn under the traditional instructional format.

Investigations endorse a constructive framework for science communication, communicating abstract aspects more efficiently proving the attempt to have the ability to turn information into useful knowledge. It has found to stress skill development nurturing the development of good habits of mind, having applications beyond passing a test. Learning through technology integrated plans and teaching materials need to include a relevant context for new information to lead to broader understandings. During traditional teaching methodology it is often hard for students to understand the connections between activities within a particular subject. This confusion is heightened when students struggle to understand the connections between different subjects within traditional classroom environment and can be overcome with the integration of technology with pedagogy. "Habits of mind" should be an important goal, or outcome, in education. These habits can produce a world view that incorporates different disciplines or subjects. They can be thought of as the "ground rules" for a particular discipline, and include, but are not limited to, verification and respect for data in science. The attempt endorses successful implementation of inquiry learning indicative of active learner involvement leading to important outcomes in the classroom. Observations indicate that participants made active observations, collected, analyzed, and synthesized information, and drew conclusions developing useful problem-solving skills. These skills can be applied to future "need to know" situations that participants shall encounter both in the educational sector and at work. Another benefit that such framework offers is the development of habits of mind that can last a lifetime and guide learning and creative thinking.

Recommendations for future research

Collaborative learning, real world application, interaction with instructors, and using technology as tools were perceived by students as helping them learn the complex concepts. Based upon the results of this study, several recommendations for further research can be generated. The exploration of the confounding effects related to learning perceptions, integration of technology in aiding the student comprehension, and the performance needs to be done to fully understand the features that enhance students learning best and which instructional formats are more potent than others.

Acknowledgment

We gratefully acknowledge the long term co-operation by the Principal, Mr. G.N. Chitte, Sangameshwar College, Solapur, for availing liberty and extended facility of the library resources for this particular research work. Last but not least I extend my gratitude to the technical laboratory staff of Department of Physics, Sangameshwar College, Solapur, for their vital role during the investigation period.

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343. Eco-Friendly Management of Phytopathogenic Fungi

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Abstract. In order to maintain the productivity of various crops more and more synthetic chemicals are being added in the natural environment by the farmers and layman who enter the food chain through water, soil and air as a result it seriously affect the human health and environment. According to the World Health Organization survey, more than 50,000 people in developing countries are annually poisoned and 5,000 die as a result of the effects of toxic agents, used in agriculture. In India 35,000 – 40,000 tons of hazardous chemicals are sprayed on the crops every year, instead of helping the poor, these chemicals are causing cancer, sterility and death. These synthetic chemicals are unsustainable and uneconomical in the long run. So there is an urgent need to develop sustainable methods for these horrible diseases. The remedy lies in the use of more natural products which do not damage the ecosystems such as biofertilisers, bioinsectisides and biofungicides. Persistent literature reveals that plants are rich sources of bioactive agents as plants and their product are known to possess various secondary metabolites including alkaloids, coumarimes, flavonoids, steroids/ terpenoids, quinines, tannins, phenolic and resins etc and are responsible for the biological activities of the plant extracts, which showed inhibitory effect against the growth of pathogens. Therefore, the plants and their product should be utilized to combat the diseases causing pathogens. So, it is advantageous to use these plant-extracts to combat the pathogens, instead of using synthetic chemicals as these chemicals are hazardous to human health and deteriorate the environment. Hence eco-friendly management of crop's diseases is the only safe substitute to be explored to control these phyto pathogens and to maintain sustainable agriculture and environment. Keeping these problems in view, efforts are underway to search economic safe phytochemicals, which could be utilized for disease control. Thus in the present study laboratory bioassays were performed to evaluate the antifungal activity of one hundred and twenty plant part extracts of hundred plants spanning over forty five families against three plant pathogenic fungi by the food poisoning method in terms of measuring the percent reduction in mycelium growth as compared to control. The various plants tested for their antifungal activity have shown varied response. The results are promising and some of the plants have shown inhibitory activity against one or two fungi whereas others have shown a broader spectrum of activity, some plants showing good activity against all the test fungi. Plants samples of some families such as Apocynaceae, Caesalpinaceae, Combretaceae, Compositae, Ebenaceae, Liliaceae, Lythraceae, Meliaceae, Mimosaceae, Rosaceae, Salvadoraceae, Sapindaceae, Theaceae and Zingibraceae were found to be comparatively more effective against the test fungi.

In view of the above facts, the present study has elaborated our knowledge by accessing the antifungal properties among the available natural flora which can subsequently be explored for the possibilities towards the identification of the key bioactive agents, through implying modern microbiology and biochemical techniques.

Keywords: Plant pathogens, Antifungal, Plant extracts, Phytochemicals

344. Challenges in Implementing the Electronic Patient Record in The Context of Healthcare Reforms in Uzbekistan

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Abstract. One of the important aims of the reforms in Uzbekistan is to deliver qualitative medical care to all citizens. On the other hand qualitative care should be safe, effective, patient centred, timely, efficient and equitable. Based on the ongoing reforms in the health care sector it was decided to implement the use of the electronic patient record (EPR) as one of tool in improving the quality of health care delivery. At the beginning the EPR is introduced in eight of the medical clinics in the capital city Tashkent as a pilot project. It's clearly that the EPR gives new opportunities including reducing clinical errors, improving patient safety, and allowing clinicians to communicate more quickly and accurately and to identify relevant information more easily. Moreover good EPR systems can increase efficiency, reduce duplication and waste, and improve the cost-effectiveness of health services. EPR systems can also make information much more readily accessible to patients, allowing them to assume more control over their health records and thereby become more active in their own care. In addition, electronic databases of health information can be used for a range of purposes other than direct care provision, for example clinical audit and research. In spite of all benefits the learnt experience showed that the following issues should be considered before implementing the (EPR) widely in the context of Uzbek health care system:

1. Many health care professionals don't know how to use computer and consequently have difficulties in using the electronic patient record.
2. It's necessary to point out that the computerization level is varied widely in different regions in Uzbekistan. That's why there's a need to change the infrastructure as well as significantly upgrading hardware software and network infrastructure where necessary.
3. EPR also brings new risks, particularly to the privacy and safety of health information. Electronic systems allow access to data from many locations, increasing the likelihood of a security breach; they can also give individuals access to much more data than was previously possible, increasing the damage caused by system misuse.

There's no doubt that EPR will be beneficial in the context of the Uzbek health care system. But it requires significant changes in the system particularly the following activities should be undertaken:

1. To educate health professional in modern information technologies as well as introduce into curriculum of medical institutes the elements of EPR system
2. To estimate the computerization level of health care facilities and to consider the patient safety.

Keywords: e-Charts, Developing country

345. Imparting Artificial Insemination Technique and Pregnancy Diagnosis to DCS Staff–A Study

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Abstract. Artificial Insemination (AI) Technique was the first great biotechnology applied to improve reproduction and genetics of farm animals. It has had an enormous impact world wide in many species, particularly in dairy animals. In India to improve the local breeds for milk production, thereby India achieved the number one position in Milk Production in the world (110 MT) Accurate artificial insemination technique requires concentration, attention to detail, a clear understanding of female reproductive anatomy and physiology. This is an art even laymen can perform, provided one should undergo proper training and trainee should work with numerous reproductive organs which are brought from slaughter house, and receive considerable practice inseminating a variety of live cows and buffaloes. This study was conducted at KMF Training Centre, Dharwad. The 30 days duration programme divided into 4 sessions: theory session, hands-on session, practical session and field session. After training it was assessed for conception rate, calf born rate and treatment done by the trainee. Some trainee needs Refresher Training. These trainees are working in the Milk Co.op. Society and doing wonderful job in the dairy battle field of artificial insemination without frontier's. "Everyone who is successful must have dreamt of something."

Keywords: Artificial Insemination, estrus, semen, Liquid nitrogen, Dairy Co-op staff

Introduction

Artificial Insemination is the deposition of semen (spermatozoa) in the female genitalia by instrument, rather than by male genitalia. The semen is collected from the male genitalia by using artificial vagina method; the same one deposited or diluted form into the female genitalia by using mechanical method (AI gun).

Artificial Insemination (AI), as practiced by bees and many other flying insects, has played an important role in plant reproduction for a very long time, use of AI in animals is a human invention and more recent. Undocumented tales exist of Arabs obtaining semen from mated mares belonging to rival groups and using the same semen to inseminate their own mares. AI had its origin in 1322 by Arabs First AI to domestic animals was conducted in dogs by Italian Physiologist. In 1678 Leenwenhock discovered the sperm and these are capable of making female pregnant. First Time in India in the year 1939 it was done by Dr. Sampath Kumar at palace dairy farm in Mysore.

In the initial stages of attempting to develop AI there were several obstacles. The general public was against research that had nothing to do with sex. Associated with this there was the fear that AI would lead to abnormalities. Finally it was difficult to secure funds, to support research because influential cattle breeders opposed AI, believing that this would destroy their market of using a bull for insemination. Later on fear was overcome with positive facts.

The acceptance of AI technique world wide provided the impetus for developing other technology such as cryopreservation and sexing of sperm, estrus cycle regulation and embryo harvesting, freezing, culture and transfer and cloning. And new, highly effective methods of sire evaluation were developed. The history of development of AI is reviewed, particularly in dairy cattle in which the impact on genetic development and control of venereal diseases has been investigated. In females detection of estrus cycle and control of estrus cycle also were important. The development of AI is a remarkable story of tireless workers dedicated to the pursuit of knowledge, to the replacement of fiction with facts, and the application thereof. In the whole world almost all developed and developing countries are accepted the AI technique. This technology is carried out by dairy farmers in some countries. Whereas in India government hospitals, milk dairy co-operative staff and NGO's are doing.

Objectives

(1) To teach trainee how to place diluted semen in the most appropriate part of the female's genitalia organs to maximize subsequent conception.
(2) Trainee should obtain a working knowledge of female reproductive anatomy and physiology.
(3) Identify the proper estrus state.
(4) Developing the skill to thread the insemination gun through the cervix.

(5) Handling of liquid nitrogen containers.
(6) The important of proper sanitation.
(7) The teaching of detection of pregnancy by use of manual palpation per rectum.

Methodology

A study was conducted at KMF Training Centre at Dharwad in North Karnataka for the last 25 years more than 3000 DCS Staff of heterogeneous mass of men and women were trained in AI & PD. For the purpose of study randomly selected 300 DCS Staff trained. A sample questionnaire was used for Primary data collection such as sex, age, qualification, socio-economical status of the trainee. And further necessary secondary data information collected from the trainee's, farmer's, Extension Officers, Veterinary Officers and other Senior union Officials about the performance of the trainee's.

(a) Sex

Sl.No.	Sex	No.	%
I	Male	2600	86.70
II	Female	400	13.30

(b) Age group

Sl.No.	Age	No.	%
I	20-25	1448	48.20
II	25-30	660	22.00
III	30-31	425	14.10
IV	35-40	327	11.00
V	40-45	140	04.70

(c) Caste group

Sl.No.	Group	No.	%
I	General	1408	46.93
II	OBC	902	30.06
III	SC	298	09.93
IV	ST	142	04.73
V	Others	250	08.35

(d) Educational qualifications

Sl.No.	Qualifications	No.	%
I	Secondary	528	17.62
II	Pre-university	1520	50.66
III	Graduate	682	22.73
IV	Post Graduate	149	04.96
V	Others	121	04.03

(e) Socio-economical status

Sl.No.	Category	No.	%
I	BPL	1525	50.83
II	SMF	1120	37.33

III	MMF	300	10.00
IV	Land Lords	55	1.84

AI training consists of 25 member trainee's in a batch, again batch is divided into 4-5 groups for the purpose practical in each group contains 5 trainee's. On first day of training registration, introduction and orientation about the programme were done.

(1) Hands on session(slaughter house)
(2) Practical session(classroom)
(3) Theory session(classroom)
(4) Field session (Hospital)

Hands on session

Veterinarians along with trainee's visit the slaughter house in the early morning. Before slaughtering the animals are brought to the near by Veterinary Hospital for rectal examination. In each group five trainees one animal is provided, for rectal examination, the trainees should be asked to have finger nails cut, Jeweler removed (female) and wear gloves with sufficient lubricants.

Veterinary doctor along with trainee put their hand together per rectal how to catch hold the cervix and examination of the different parts of the female genitalia such as uterine hams, uterine body, ovaries, matured follicles and corpusluteum while practicing repeated / in expert practice of the produce may result in severe straining, ballooning of the rectum, bleeding or some times thickening of the rectal wall in such condition animal may be replaced, Usually five trainee's are allowed to examine. One animal in the beginning session later on up to eight are allowed to examination. Animals used for hands-on session once session not be reused (same day these animals are slaughter). While palpating reproductive tract to find the anatomical land mark for insemination trainee will usually obtain an idea of the overall size of the reproductive tract. Some trainee's may get the impression that the larger the cervix is the longer the reproductive track, this assumption is not correct. There is not a strong relationship between size of the uterine body and the diameter of the cervix or length of the reproductive tract. This may lead to inseminators/trainee making insemination errors. This hands-on session (slaughter house) is about 10 days. By the end of this session trainee will able to asses the reproductive tract size, different parts of the uterus, callable of catch hold of the cervix without much strain/bleeding and he/she is able to pass the AI gun through cervix because some animals are in estrus stage, some may be infected with venerable diseases. In per rectal examination some animals are found pregnant, trainee will get the idea about the size of the uterine horns and appropriate duration of the pregnancy.

Practical session (class room)

The slaughtered animals uterus are brought to training centre for examination on table these specimen are placed/examined for:

(a) Identification of different genitalia parts.
(b) Passing the AI gun without seeing the specimen.
(c) Dissection of the genitalia to show the interior of the uterus such as cotyledons, ovaries, corpusluteum, follicles developed and developing.
(d) Pregnant uterus–fetus, foetal membranes, flints, umblical cord, etc.

Theory session (class room)

The following subjects taught to trainee in the class room session:

- Trainees should obtain a good knowledge of reproductive anatomy and physiology of female & male organs.
- Developing the skill to thread the insemination gun through the cervix should not be the only objective and also
- The importance of sanitation and thawing methods.
- The perfection of skills to consistency identifies the proper site of semen deposition.
- Handling of container (liquid nitrogen) and its importance.
- AI history, advantages, management Breeding and feeding and disease control measures.
- Role of hormones produced by the different glands and their role in reproduction.
- Pregnancy diagnosis and its importance.

- Veterinary First Aid drugs and its uses.
- End of the session Pashupalan A.V. cassette.

Field session (hospital visits)

Each group will be sent to visit different village level Veterinary Hospital daily in charge of the Veterinary Hospital will take care of the supervision work. Daily trainee's will assess for the following aspects:

(1) Identification breed, age, stage of lactation, general body condition of the animal.
(2) Identification of estrus stage and symptoms externally as well as internal.
(3) Thawing of the semen straw and loading of the AI gun.
(4) Sanitation procedure.
(5) Thread the gun through cervix and placing into the uterine body.
(6) Deposition of the diluted semen.
(7) Recording.
(8) Any advice to the farmer/treatment/follow-ups if any.

Pregnancy

Students/ trainees must prior instruction on the anatomy and physiology of the genatelia of female reproductive organs are given with help of slides, videos and also slaughter house, specimens, inserting the lubricated hands per rectal observe the enlargement of the uterine horns either left or right is the most appropriate method of diagnosing the pregnancy in cows and buffaloes in case of heifers it is easy to diagnosis where as it is difficult in 3-4 calved animals.

Observations: In AI technique

Some of the observations are made while practicing the AI technique.

(1) To avoid the possibility of entering the urethwal opening on the floor of vagina, the insemination (AI) gun should be inserted into the Vulva upward at a 30 C to 40 C angle.

(2) To place the cervix into the insemination gun, maintain slight forward pressure on the gun while manipulating the cervix and slightly ahead of the gun.

(3) The anterior portion of the vagina, termed the formixvagina, tends to stretch rather easily when the insemination gun is pushed forward and beyond the cervix. This may give the false impression that the gun is advancing through the cervix, when indeed it is above, below or to either side of the cervix. But unable to feel the tip of the gun in the cervix(gun may be in the vaginal fold)

(4) The semen deposition place in the female genitalia in the uterine body is quite small, accurate gun tip placement is probably the most important skill involved in the whole AI technique.

(5) Once the gun tip is aligned with the internal cervical os, deposit the semen. Semen deposition take about 5 seconds, slow delivery maximizes the amount of semen delivered straw and minimizes unequal flow of semen into one uterine horn.

(6) During the process of semen deposition, care should take fingers of the palpating hand or not inadvertently, blocking a uterine horn or misdirecting the flow of semen in some manner.

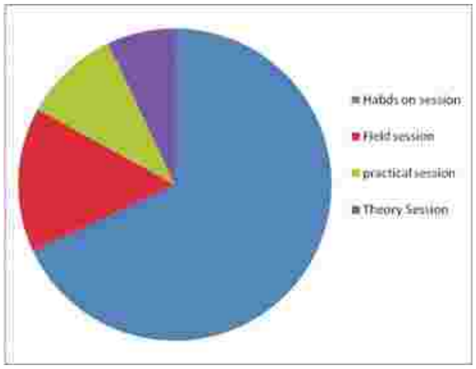
(7) Not to pull the insemination gun back through the service while the semen is being expelled.

(8) If the animal has moved during the semen deposition, if AI gun has moved, stop the semen deposition and correctly reposition the gun tip in to the uterine body and deposit the semen. Inseminators generally identify this target area by feeling for the end of the cervix and tip of the gun as the gun

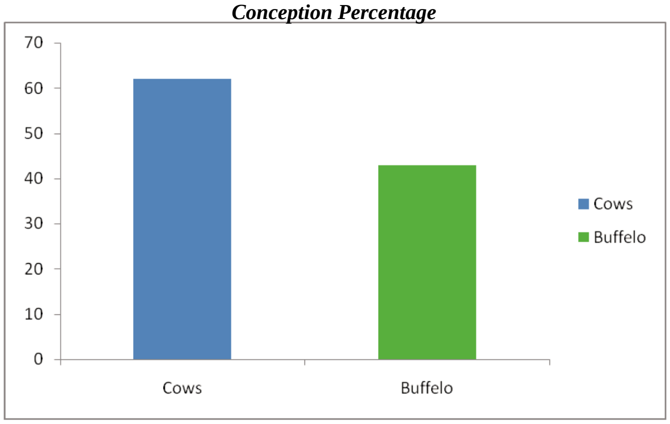
emerges through the internal as or opening, depositing the semen in the cervix or randomly in the uterine horns may result in lower conception rates.

Discussion & Analysis

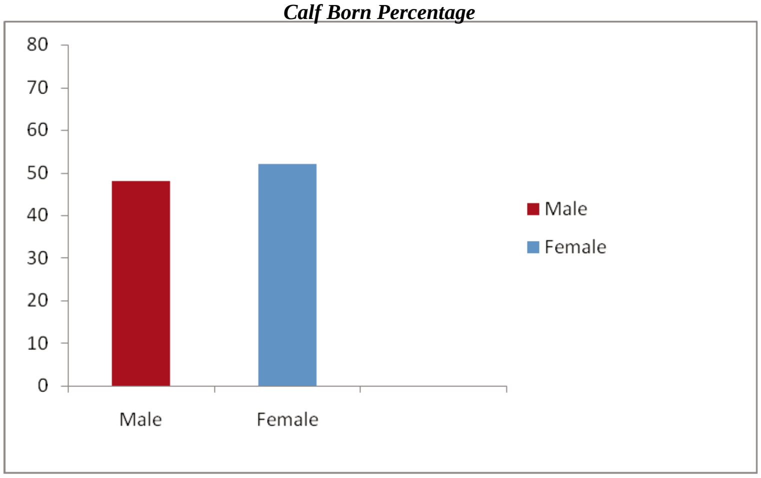
AI and Pregnancy diagnosis technique methods are highly technical and trainee's needs more hard work with memories reproductive tracts and receive considerable practice inseminating a variety of live cows and buffaloes. Developing the skill to pass the AI gun through cervix, handling of LN2 containers, sanitation and managemental aspects are also very important, since the largest group is heterogeneous mass of both sex, they needs different method and technique to understand the technical training. The most of the trainee's expressed their satisfaction 68%. Hands on session and field session are most suitable for the learning complicated technical training. 15% were happy with practical session, 10% were happy with theory session (class room) and 0.7% were happy with audio visual sessions and refresher training.



Conception Percentage



Calf Born Percentage



Conclusion

The knowledge gained from the AI experience was extremely helpful in stepwise developments of each successive, reproductive technology, such as frozen semen, superovulation, embryo transfer and eventually, cloning. And at the same time public become better informed and more willing to accept the technology developed with worthy goals, and built in ethical application, could produce positive change benefiting the whole farming community especially in India. Worthy goals development of the necessary knowledge and skills ethical considerations all are essential components of any technology that will result in a positive impact on society and the environment. Thus, the impact of artificial insemination was much more profound then simply another way to impregnate females. The study revealed and it is found that, Hands on session and Field Session are most suitable for the imparting AI technique and P.D. to DCS staff as per the study conducted at our training centre.

Recommendations

1. After evaluating records, visit to Dairy Co-operative Societies, farmers interview if it appears insemination may be a problem. Then, consideration for AI refresher training.
2. All the AI workers should periodically attend a refresher training programme to review their technique, learn new developments and obtain recommendations regarding artificial insemination and pregnancy diagnosis technique.

Acknowledgement

Special Thanks to Shri. A.S. Premanath Managing Director, KMF Bangalore and Dr. Bernad Earnest, Additional Director, KMF Bangalore.

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VDS
Vaigyanik Drishtikon Society

ISWA

ICSC
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IJSC
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PCST Network

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National Council for Science & Technology Communication

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Science News Coverage and Its Impact on Readers: A Study of Science Popularization through Newspapers in Uttarakhand

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Abstract. Though the media is doing some what good to disseminate the science but media alone is not capable to make the public aware about the science. The very reason behind this fact is that the most of the reader are not convinced why to read the science news? That is the reason where science communication gets paralyzed as far as science popularization through news papers or print media is concerned. This theory is based on a study conducted under 'Rajat Jayanti Vigyan Sancharak Fellowship-2009' in uttarakhand. For this purpose six most circulated news papers were chosen for content analysis while a preliminary survey of the study field was conducted to know the actual position of popularity and impact of science news. In this research paper science coverage by the news papers have been discussed in details as their presentation, terminology, follow up etc.

Keywords: Science communication, Print media, Presentation, News papers, Content analysis, Terminology

Introduction

The founding Fathers of the Indian republic gave great importance to the cultivation of a `scientific temper' by incorporating it in the Constitution. Under article 51(a) in Fundamental Duties it is clearly mentioned that it shall be the duty of every citizen of India to develop the scientific temper and sprit of inquiry. These duties are obligatory for a citizen. In our constitution media does not have any specific privilege other than a citizen of India, so the media is also liable to follow same duties as per the citizen of India has. But instead of this, Media's sensationalism approach, illogical and unscientific thoughts are prevailing in the society and particularly in the new generation. That's why besides being adhere to the scientific notions and logics, this new generation is having distance from it. Even 'National Knowledge Commission' on May 2008, in its report tabled before Prime Minister of India grieved over the fact that the percentage of science students is declining continuously. In its report commission further elaborates that the interest of students for science, as a subject in college level, is diverting.

Because science and technology is the fundamental to the society for its growth and development but there is still a considerable gap between science community and society. The Scientists engaged in their researches, write their findings in the scientific language, which is not to be understand by a common man. As we know that the media are key shapers of public opinion, the more effective communication to the public is increasingly necessary for the scientific community. But without media support this goal remains out of sight. Writing about science journalism in his book 'The Wisdom of Science', R. Hanbury Brown has moaned "Although advances in science and technology have given us an unparalleled ability to communicate with one another by radio, television and vast quantities of print, these so-called 'media' are seldom used to tell us anything about science…." On the other hand Dr. Jayant V. Narlikar says that the astrological forecasts appear regularly in our newspapers but science and technology is touched if at all, only with a bargepole. Newspapers play a vital role in spreading information and opinion in times of stress. In the present age of science they should not treat science journalism as quiet backwaters. They should look upon it as an ocean vibrant with waves and tides that affect our destiny.

Directorate-General for Research of the European Commission analyzed those points due to which science cannot get space in media. In its findings commission says that although the media see information from the scientific community as of high importance, they find this information to be complex and difficult to understand and consequently it is more difficult to use in a highly time-pressured environment. Due to these complexities media cannot take the message of science to the masses.

The problem is that the science issues hardly can arrange a space in media among the social, political, sensational, glamour and murder mysteries. Media players do not also think general science to be such hottest and burning topic which can bring for them a good readership. Irony is that, whenever new discoveries and any happenings take place in our surroundings, then only science is needed by the media. While on the other hand superstitions, astrology, fashion, glamour, sensationalism etc. are enforced in the society by the media. Though the media covers science issues occasionally but even the intention behind these stories is not to spread the very basic concept of science and its impact, rather to create illusion in the public. A most common news broadcast by news channels time and again is sufficient to proof this hypothesis. On 11th of May 2008, Sunday at 9.30 pm, renowned news channel started telecast a special story on the life of earth under the title of 'Dharti Ke Bas Char Saal'. In this news story it was said that on 21st Dec. 2012, the whole earth would be engulfed by the Sun. Since then many channels have broadcast the same story many times whenever they feel empty. Though everybody knew that it was totally illogical but even news channel got its theory endorsed by the version of D.U. Professor R.P. Tandon. This shows the sincerity of media for the science and society. We know that the media either print or electronic, are the only tools which can make the common people aware about the happenings. For this purpose follow up of any news story can play a vital role to make an undying impression in the mind of public.

Objectives

It is well known fact that the newspapers not only inform public about new scientific finding but also provides a lot of literature to enhance their knowledge. That's why for this purpose the coverage of science issues in print media becomes needed. Because the purpose of science coverage in media is solved only when even a layman can understand basic concepts of science which we want to disseminate. We know that the science and technology play a lead role in development of man and its society. All the facilities and prosperity in our life is the blessings of science. That's why it becomes mandatory to know the public attitude towards scientific aptitude. Because science is the backbone of all the developments, it is the duty of science community as well as media personnel to join hand for the sake of development. The present study aims to assess the role of newspapers in science popularization in Uttarakhand State. This study will assess present status of science news as how many newspapers do focus on science news and the popularity of science news among the masses. The following objectives are developed to conduct the study.

1. To study the present status of science news in newspapers.
2. To assess the popularity of science news published through newspapers.
3. To find out the actual position as space, placing and terminology of science news in newspapers.

Methodology

Science communication is an investment in human resource development as it plays key role in advancing human prosperity. This study will assess the role of newspapers in bringing awareness, arousing curiosity, creating interest, persuading and educating people for their betterment. In this study six most circulated newspapers (four hindi and two english) in Uttarakhand were taken for the content analysis. These are as Amar ujala, Dainik Jagran, Hindustan, Rashtriaya Sahara, The Pioneer and Garhwal post. As far as the coverage of science news through these newspapers is concerned, science news was categories into eight parts viz Environment, Health, Information Technology, Science & Society, Astronomy, Wild Life, Science & Technology and Miscellaneous. To know the actual position of science coverage, its utility and the taste of the readers, questionnaire was developed in such a way that the recent science related news could be included. For the testing of questionnaire or schedule a pilot surveys was conducted in Uttarakhand. Readers were asked about only latest science news coverage through print media. During the pilot survey readers were interviewed personally about their media habits and the taste of science news reading. In this study total 84 newspapers (six newspapers from 5- 11 June and the same six newspapers 5 – 11 August) were evaluated during this period. To know the impact of science news on the masses 30 people were interviewed.

Results and Analysis

The collected data were analyzed and the results are shown as follows:

Table 1 shows the percentage of science news published in different newspapers. This shows that only Garhwal Post (English daily) give the more importance to science news. Though most of the science news are taken from agencies yet it published science items often regularly. Amar Ujala which is the most circulated newspaper of Uttarakhand does not give much attention to the science news.

Table 1. Percentage of science news published by all six newspapers

News Papers	Science news coverage (sq.cm.)	Total news coverage (sq.cm.)	% of science news
Amar Ujala	8573.5	288630.5	2.97
Dainik Jagran	12263.75	299018	4.10
Hindustan	17961	303864	5.91
Rashtriya Sahara	30372.25	369176	8.22
The Pioneer	16624.75	343866.75	4.83
Garhwal Post	20281.25	173611	11.68

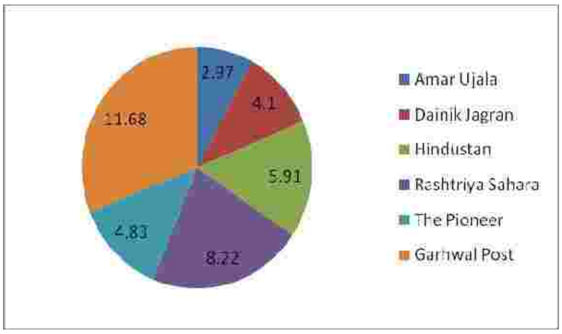

Figure 1. News paper wise distribution of science news in percentage.

Table 2 shows the category wise percentage of science news that were published by newspapers. This shows that though only 6% space is given to science news as whole but the environment is always on the top priority of newspapers. Though health is not less desirable topic by the media but the science and technology is lagging behind more with mere 2 percent.

Table 2. Category wise percentage of science news published in all the news papers

<table>
<tr><th></th><th>Category of science news</th><th>Size (sq.cm.)</th><th>Total Coverage of science news sq.cm.)</th><th>% (Category wise)</th><th>Total News coverage (sq.cm.)</th><th>% of science news</th></tr>
<tr><td></td><td>Environment</td><td>35690.5</td><td rowspan="8">107822</td><td>33.10</td><td rowspan="8">1778166.25</td><td rowspan="8">6.06</td></tr>
<tr><td></td><td>Health</td><td>32509.5</td><td>30.15</td></tr>
<tr><td></td><td>Information Technology</td><td>5643</td><td>5.23</td></tr>
<tr><td></td><td>Science & Society</td><td>5984.25</td><td>5.55</td></tr>
<tr><td></td><td>Space Science</td><td>4595.5</td><td>4.26</td></tr>
<tr><td></td><td>Wild Life</td><td>6504.25</td><td>6.03</td></tr>
<tr><td></td><td>Science & Technology</td><td>2896.75</td><td>2.69</td></tr>
<tr><td></td><td>Miscellaneous</td><td>13998.25</td><td>12.98</td></tr>
<tr><td></td><td>Total</td><td>107822</td><td></td><td></td><td></td><td></td></tr>
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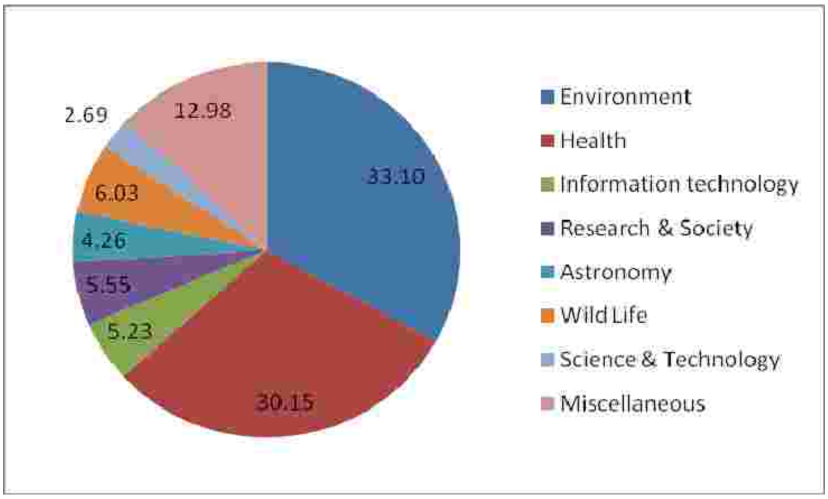

Figure 2. Category wise percentage of science news published in all the news papers.

Table 3 shows that newspapers do not give science news an important placing also. Out of all 441 science stories or items only 14 science news were placed in front page while 74 were placed on the last page. It is also clear from the table that Rashtriya Sahara gives more emphasis to science news as far as its presentation and placing is concerned. On the last page it placed 43 news items while Amar Ujala, The Pioneer and Garhwal Post did not placed any science news item on the last page.

Table 3. Placing of science news items in different newspapers

	News Paper	No. of total news	No. of front page news	No. of last page news
1	Amar Ujala	56	1	0
2	Dainik Jagran	63	5	7
3	Hindustan	82	2	24
4	Rashtriya Sahara	121	2	43
5	The Pioneer	60	4	0
6	Garhwa Post	59	0	0

Qno. Do you read science news regularly?

On the above question, 46.66 % readers said that they did not read science news while only 20% readers said that they read science news regularly. It was found that only graduate males showed their interest in science news. 33.33% of readers said that they read science news only if it has direct concern with their daily life such as medical, new technology etc.

Qno. Should newspapers give more space to science news?

On this question 73.33% readers want that newspapers should give more space while only 26.66% readers do not think it to be important. Though the most of the readers think that science is essential for everybody but the irony is that the most of the readers are not interested in science news reading as shown in table 4.

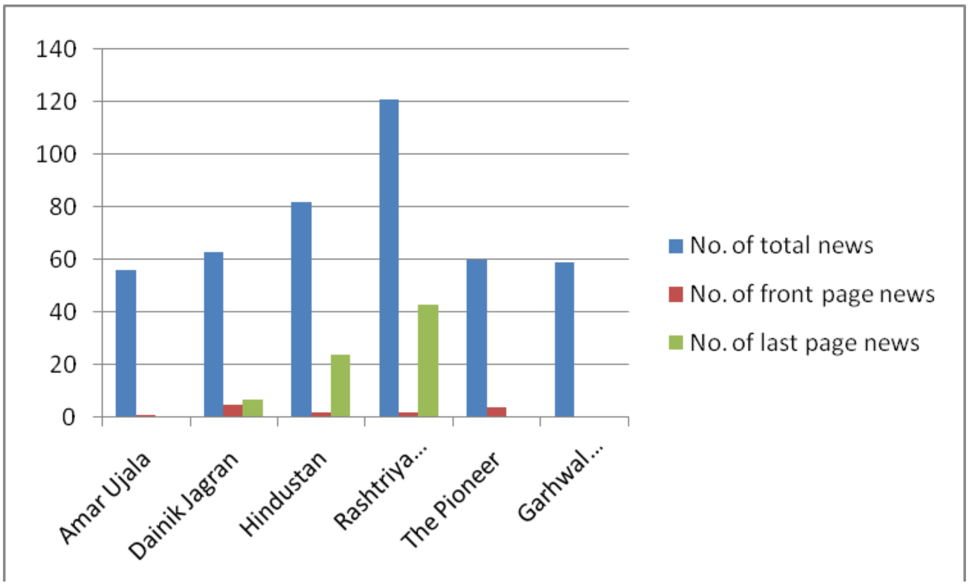

Figure 3. No. of science news items placed in either front page or last page as per the preference of news papers.

Table 4. Response of the readers about their science news reading habits

No. of total respondents	Reads occasionally	Yes	No
30	10	6	14

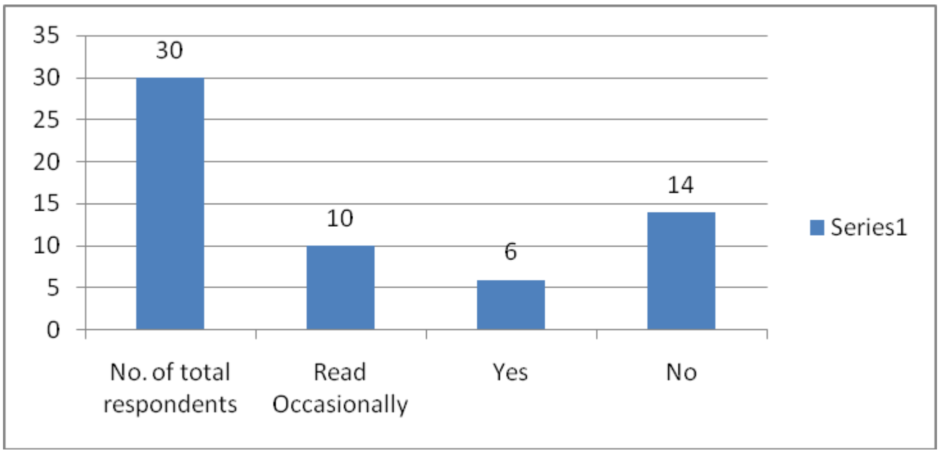

Figure 4. Response of the readers about their science news reading habits.

Table 5. Readers' attitude about the science news

No. of Respondents	Yes	No
30	22	8

Qno. What type of problem/s do you face while reading science news?

This questions shows that most of the readers do face problems in terminologies used in newspapers. 20% readers said that the understanding of science is a problem itself while 16.66% readers think that the big problem is with the way of science writing. 23.33% of readers think that the presentation of science news is not such that reader can attract easily.

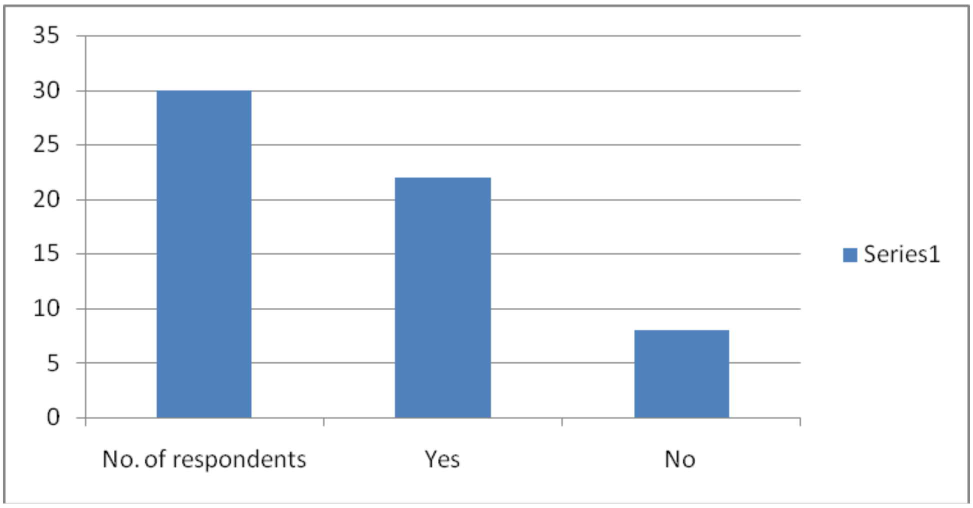

Figure 5. Readers' attitude about the science news

Table 6. Types of problems while reading newspapers.

No. of respondents	Understanding science	Terminology	Presentation of science news	Uninterested way of Science news writing	None
30	6	8	7	5	4

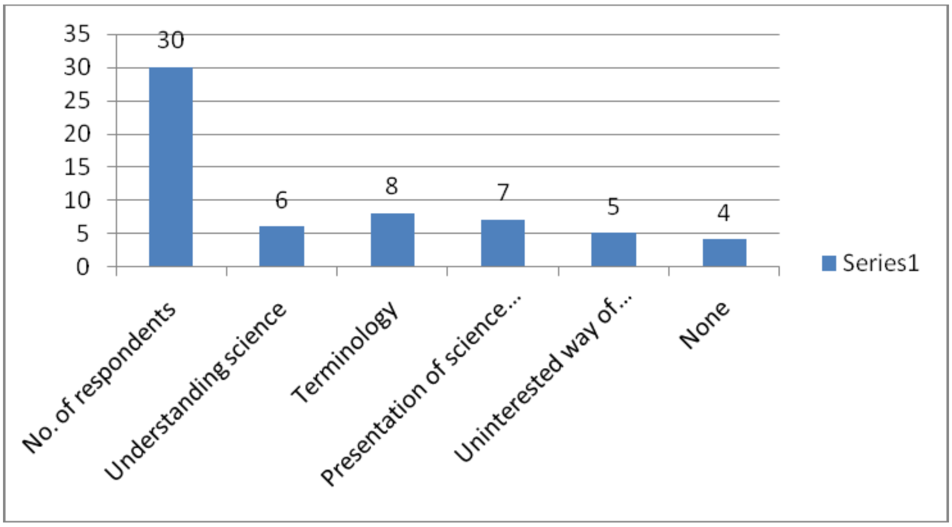

Figure 6. Types of problems while reading science news

Conclusion

The result of this study shows that the coverage of science news through newspapers is at the bottom. Only 6% coverage of science news is not such that can attract the most readers easily. During the analysis it was found that in these 84 newspapers only 441 science news items were published. As far as the space is concerned, in these newspapers the total space given to all types of news items was 1778166.25 cm. square, while the total space given to science news was 107822 cm. square only, which shows that only 6.06% space is being given to science related news. The scientific terminology used in the newspapers was found beyond the access of common mind. These terminologies such as Hydraulic, Deforestation, Inorganic, Oxidized, Metabolic, Climate Change, Biotechnology and many more were not made clear for the common reader. In the preliminary field survey of the State shows that most of the people do not prefer to read science related news. The most astonishing fact of the study came to know that availability of the newspapers in the villages is almost negligible. In rural areas, most of the villagers do not prefer to subscribe any newspaper. Instead of this they prefer to read the newspaper in the local market belong to that area. It shows that the dependency on newspapers alone is not the permanent solution. It means we have to adopt some parallel tools of communication along with the media to make people known about the relevancy of the science.

Acknowledgements

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Scientific Awareness: Challenges and Opportunities for Linguo-Socio-Culturally Divergent India

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Abstract. Developing scientific awareness among the masses is the need of the hour. In this way one can connect the general public with the specialist scientific community. Every nation is trying hard to make their public scientifically aware for social welfare and development, national advancement, appreciation and criticism of scientific advances, to end the possible superstitions and blind faiths, to strengthen the public faith on the doctrine of science and for establishing a direct link between science and society. The difficulty of spreading scientific awareness in a country like India is further multiplied by the various challenges of linguistic, social, cultural and economic diversity prevalent in the country. To meet these challenges, it is very much required to exploit the available opportunities and to come up with new ones. The present paper proposes to discuss the various challenges and opportunities for spreading scientific awareness in India.

Keywords: scientific awareness, challenges, opportunities, India.

A General Research about the Role of Science Center and Science Museum—From the Perspective of Dealing with the Global-Warming Problem

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Abstract. As we all know, Climate-warming has become an indisputable fact, and this world-wide problem brings a series of serious results, such as climate change, the rising of sea-level and acceleration of glacier-melting, endless natural disasters and so on, which pose a serious survival challenge to all living things, including human beings. Climate-warming is a global problem, and it is the common challenge facing the whole people of the world, we have to attach a great importance to it.

This paper argues that, to deal with global Climate-warming, all the countries in the world need to act together, as for each individual, the most important point is to develop a low-carbon lifestyle, which advocated during the Climate Change Conference in Copenhagen in 2009.

Then, as the main place for people to get knowledge and attitudes about science and experience scientific research, what role should modern science center and science museum to play in dealing with this crucial and urgent global climate-warming?

This paper argues that, based on the above question, The modern science center and science museum should pay much more attention to help people understand and learn how to deal with climate-warming, not only just focus on the popularization of the knowledge of science & technology, scientific & technological achievements, and providing places for people to play interesting experimental games.

Modern science centers and science museums should establish a special area for climate-warming problem, where people have access to know the origin of climate-warming and what challenges it has posed to the whole world, it helps people realize the importance and the urgency for all countries to deal with climate-warming problem, it shows people the achievements which have been made in recent decades, it also introduce the main practices adopted by all countries in the world, The most important point is help people get knowledge about how to deal with climate-warming in everyday life, introducing low-carbon knowledge to people, advocating low-carbon lifestyle, help people develop low-carbon living habits in every detail of daily life and make contributions when it comes to the climate-warming problem.

Keywords: Science center and science museum, Climate change, Low-carbon

Science Center and Science Museum

Since it comes into being, the science center and science museum undertakes an important mission, which is popularizing knowledge of science and technology, advocating scientific methods, propagating scientific ideas and promoting the scientific spirits. And the traditional science center and science museum has been always practicing this mission, it emphasizes building scientific atmosphere, stimulating interest in science, it also attach a great importance to the exhibiting education, and the content of the exhibition mainly focuses on the concept and achievement of science and technology, including its influences on people's daily life.

But the roles of the science center and science museum in the whole world are not the same, they have different key points. Guangdong science center is the largest science -popularization base in Asia at the present, it is the platform for the exhibition, spreading and trading of scientific products, it also provides academic exchanges. Paris discovery palace in

France gets the exhibition and the experiment together, it lays emphasis on inspiration and participation, and its purpose is helping people study during the exploration, and therefore improves their knowledge of science and technology. The San Francisco Exploratorium in USA focuses on the revelation of scientific principle; it emphasizes taking initiative as well as using both head and hand. The miraikan in Japan takes its position based on frontier science and advanced science; it mainly provides scientists a place for understanding of the latest scientific and technological developments. The science museum in Hong Kong focuses on the people's participation, it lets people have fun during the participation, it organizes high-quality exhibitions and interesting scientific programs, with the aim of popularization of science, besides, it helps schools carry out science and technology education. it also encourages people to find out the scientific principles through the operation of the exhibits, and let them experience the pleasure when exploring and studying science.

Based on the research of the roles of science centers and science museums in several countries or areas, we can draw a conclusion, that is, the traditional science center and science museum's main purpose is helping people get knowledge and experience the fun of science and technology, and this kind of running mode of science center and science museum is quite common, it focuses on the popularization and dissemination of scientific knowledge, it also emphasizes the mastery and application of science and technology, and the ultimate aim is promoting human's development, including the change of living style and the improvement of living standards, etc.

Roles of Modern Science Centers and Science Museums

As we all know, with the emergence and development of science and technology, the human's living and production style has been greatly changed, the progress of human civilization has also been speeded up, since that, people has mastered a better understanding of the nature, and then, people could make full use of the nature. Besides, with the knowledge of science and knowledge, people could adopt scientific methods to avoid natural disasters. But since stepping into the 20th century, the disasters human experienced and faced are more and more, and the natural disasters has become the major challenges for people, and they are even threatening the existence of all life in the world.

The natural disasters are the abnormal phenomenon in the nature, and they influence people's life from time to time. The damage caused by the natural disasters is usually frightening, and the loss is also very heavy. The common natural disasters usually break out suddenly, such as earthquakes, erupting volcanoes, floods, typhoon and tsunami, etc. Environmental disasters like ozonosphere changes, water pollution, soil erosion and acid rain, are produced by human activities. Besides, disasters, such as glacier melting, land desertification, drought, coastline variation and so on, develop its influence in a long time, and they do damage to human gradually. These natural disasters have a complex relationship with the environmental damage. Within the 21st century, the most important natural disaster the scientists discuss could be climate change. The rapid melting glaciers in gl Greenland, the frequent extreme heat in whole world are the serious consequences caused by climate change.

The occurrence of all these disasters existing in the nature are caused by the invincible natural factors, what's more, the factors produced by human activities could not be ignored. Then, as to these natural disasters, particularly the issue of the climate warming, is there anything we can do about it? When we make progress in science and technology and enjoy a better civilization, should not we adopt a scientific way to prevent or reduce the occurrence of these disasters?

The answer is yes, we have to get knowledge of these disasters occurrence and development from the scientific perspective, and then try to reduce the hazards, and it has become a common theme of the international community.

Dealing with these natural disasters, we need not only scientist to strengthen the scientific and technological breakthrough, but also the innovation of science and technology, what's more, we need everyone in the world take actions to combat the natural disasters, and use the scientific method and means to reduce the occurrence of disasters or damage caused by them.

Do people know how to combat natural disasters inherently? Do people know how to avoid damage caused by disasters inherently? No, when people get knowledge about these disasters, including the causes and the results, and learn how to do to avoid them, so that people could be free from all damages, or at least less.

There are different ways for people to get knowledge about the disasters, such as watching television, logging on internet, reading books and so on, but through these ways, people's consciousness of taking initiative to prevent and avoid disaster could not be stimulated, it also can't offer people a more powerful feelings towards disaster. To stimulate people's consciousness of taking initiative to prevent and avoid disaster, we must bring people a true sense of disaster and its severe consequences, etc.

The science center and science museum is a place where scientific knowledge is disseminated; it provides people a space to experience freely. Therefore, in order to offer people a more truly and powerful feelings towards disaster, the science center and science museum must take actions, it should not just hold the ideas of popularizing knowledge of science and technology, exhibiting scientific products, enjoying scientific fun and so on, the science center and science museum should show some scientific and effective methods to prevent and avoid disasters, as to dealing with climate change that concerns all living beings on earth, it becomes more urgent.

Climate Change: A Challenge for Human Society

The Copenhagen climate change summit held in September, 2009, has been considered as the most important meeting when it comes to the sustainable development of the whole world, it is also considered to change the fate of the earth. Thus, we can learn that how serious the climate change is for the survival of mankind. But at this summit, because of the interest conflict, the leaders of countries failed to reach an agreement on dealing with climate change; This means that the climate change will bring more harm to the whole world in the near future.

Then, what challenges the climate change brings to the earth? This paper expounds main some challenges listed as follows. First, is the global glacier melt. It causes a series of problems such as flood, drought, drinking water reduction and so on, these are the major issues related to human survival； Second, the extreme climate. Such as the blizzard, storms, hail, lightning, typhoons, and so on. The study shows that since the 1970s, the scope of drought has become broader, its duration becomes longer, and the result becomes more serious, particularly in the tropical and subtropical regions；Thirdly, the reduction of grain output. The global warming may lead to the instability of the agricultural production; problems like high temperature, drought, the pests may cause the reduction of grain output. Meanwhile, the rising of the temperature will expand the region where agricultural disease exists. Therefore, the influence on the crops will be worse, and finally leads to the increasing usage of the agricultural herbicides； Fourth, the rising of sea level. Due to the rising of sea level, various island countries are faced with problems like the shrinking of the land area, moreover, some island countries may be drowned. A survey shows, more than 70% people of the whole world live in coastal plain, among the 15 biggest cities, there are 11 located at the coastal area or the river mouth. once the sea level rises beyond a certain bound, people living in these areas will also face the danger of being drowned ; Fifth, the extinction of species. The fourth assessment report released by the intergovernmental panel on climate change (IPCC) in 2007 points out that, in next sixty to seventy years, the climate change will lead to the extinction of a large number of species, as a member of the universe, may the human beings also be faced with this embarrassing situation one day?

The above five points are not just an alarming talk; they do exist in our daily life. If we don't take actions, we may do have to experience this serious consequences.

As we can see, dealing with the climate change can not be delayed anymore. Then how to cope with the challenges brought by the climate change? What should we do? As to each individual, a consensus has been reached, that is reducing the disasters brought by the climate change, and the most important point is guiding people to develop a low-carbon living style in our daily life.

Modern Science Center and Science Museum vis-a-vis Climate Change

Generally speaking, the science center and science museum consists of several exhibition areas, which are designed for the different exhibits. Each exhibition area has a main theme, such as Science and Technology in daily life, Exploration and Discovery, Science Park, Future and Challenge. With a main theme in each area, people could feel more convenient to visit. Besides, most science centers and science museums have a temporary exhibition area, which mainly used to exhibit the latest technology, products or research results. But the science centers and science museums with the theme of dealing with the climate change is few, most science centers and science museums have no relevant exhibition area. It is not in accordance with the development of human society. the development of human society is the sustainable development of human civilization, it aims at increasing people's living standards and improving the existing environment, and in order to achieve these aims, just relying on the scientific and technological progress is not enough, we should also need to reduce the violation of the nature as well as raise the ability of preventing and reducing disaster brought by the climate change.

After all, most people visiting science center and science museum want to learn science, get a better knowledge about science and technology, and then make full use of it so as to improving living conditions and environment. But various disasters brought by the climate change affect people’s life at any time, and it appears to be more frequent in recent decades. But people’s consciousness of dealing with the climate change is not strong enough, in fact, most people think that dealing with the climate change is just the responsibility of a country, and have nothing to do with each individual.

While, dealing with the climate change is the common challenge for the entire humankind, it requires the concerted action of the entire humankind. In this sense, setting up a exhibition area with the theme of dealing with the climate change is becoming increasingly urgent.

Then, how to design the exhibition areas with the theme of dealing with the climate change so as to attract people's interest and let people take initiative to combat the climate change? This is an important but difficult issue. As we all know, such as driving cars once in a while, using less plastic bags, stopping cutting trees and so on, are the concrete actions for all individuals to combat the climate change, but taking these actions will inevitably affect people's lives, but if we don't do it, dealing with the climate change will be an empty talk.

Therefore, when designing the exhibition area with the theme of combating the climate change, the science center and science museum has to attach much importance to the aspects such as the exhibition area's designing, decoration、operation and so on. Let people have a shock from the bottom of the heart after visiting this special exhibition area, and help them give up the narrow consciousness of emphasizing personal interests and neglecting the existence of all humankind.

Then how to design the exhibition area with the theme of combating the climate change? The follow four aspects are strongly recommended to finish the layout. Relevant information on climate change has been introduced in the first part. When people talking about the climate change, the most direct understanding on it is the global warming, but where does the problem of global warming come from? What negative influences it brings to us? And how do these influences effect all the living things existing on earth? As to these questions, they do not know. While if they do not know the basic knowledge about the climate change, they will not take any action to combat the climate change. to be more strict, the global warming will be further increased. Therefore, introducing some relevant information on climate change is rather important. At the beginning of the exhibition area, the knowledge about the climate change should be introduced through texts, pictures, figures. The main text should include the origin of the climate change, but the written language should not be excessive, otherwise, people will neglect this part for the long texts. Some pictures may be added in appropriately, these pictures should be real and close to people's life, only in this way, people can be shocked after visiting. The numbers referred should be accurate and surveyable. In short, people's interest in climate change should be stimulated as much as possible in this part, and let them think that the problems caused by the climate change are closely related to everyone.

After introducing the relevant information on climate change, it is necessary to assume some circumstances if the problems of climate change aggravates and what might happen to the survival environment of humankind. That means simulating the survival situation after the global climate changes. In this part, much more attention should be paid to people's feelings. Designing a simulated environment, such as the increased temperature, with the aim to reinforce people's feelings of the impact brought by the climate warming, and therefore, help people recognize the responsibility and urgency for combating the climate change and take actions more consciously to protect our homeland.

Since people visiting in the science center and science museum, it is essential to introduce the research result of combating the climate warming by scientists to visitors. In this part, the exhibition content should be provided as rich as possible, including the latest research results and the efforts paid by the scientist, such as the development and application of new energy. In addition, some international conferences on global climate change as well as policies and measures adopted by the governments may be also introduced in this section, let people know that combating the climate change is not just the task for scientists and governments, everyone has the responsibility to join in this meaningful action.

The last part is the most important part. In this part, knowledge about combating the problems caused by the climate change in daily-life should be introduced to people with detailed presentation. the content of this part should be close to people's life, it may be classified according to people's eating, clothing, housing and move. As to eating, it is necessary to advise people don't eat those precious, rare or endangered animals and plants, so as to keep the ecological equilibrium and maintain the biodiversity. As to clothing, it is necessary to recommend people choosing clothes made of cotton, linen and silk, for they are not only green and durable, but also fashionable and elegant. As to housing, emphasis should be put on conserving water, saving electricity and avoid energy waste. As to move, it is essential to advocate green traffic ways, green and energy-saving policy should be also promoted, such as no driving or less driving.

In short, introducing knowledge about how to combat the disasters caused by the climate change in daily-life to people is quite significant for science center and science museum at present, it is also of great urgency for science center and science museum to help people form good habits and lifestyle so as to dealing with the global climate change.

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On the Social Responsibility of Science Popularization

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Abstract. This paper debates that science popularization has its own important responsibility for local society and global community, as well as for the whole humanity and lives in the earth. Science communicators should deliberately choose appropriate contents and approaches to communicate science and technology knowledge that base on the evaluation and value judgment. As for that purpose, the author further argued that communicators should have an evaluative thinking in the process of science communicating. He also elaborates the important role that evaluation has played in perfecting the practical programs theories, building the scientific outlook on development under the new historical conditions. The author holds that evaluative thinking parallel with critical thinking is one of the most useful ways to guarantee a better play of the role of science and technology communication in serving our society while we confront many global problems.

Keywords: Social Responsibility, Science Communication, Evaluative Thinking, Environment of Assessment

Agenda Setting Process in China's Science Popularization Policy: A Case Study of the National Action Scheme for All Citizen's Scientific Literacy

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Abstract. Science popularization policy (SPP) is a key instrument to promote public communication of science and technology, and to improve citizens' scientific literacy. Since 1990s, Chinese Central Government has issued three top level SPP, i.e., "Opinions on reinforcing science popularization" in 1994, "Law of science popularization" in 2002, and "Outline of national action scheme for all citizens' scientific literacy" in 2006, which constitute three milestones in the development of China's SPP system.

Our research questions are: (1) how the agenda of the SPP were set? (2) Which model of agenda-setting in the public policy field could be applied to analyze the Chinese cases of SPP agenda setting? (3) Is the model of agenda-setting testified, modified or falsified in the Chinese context of SPP? (4) What are the Characteristics of and Challenges for SPP agenda-setting? The authors get relevant data from several sources. (1) Primary literature on the SPP documents; (2) accounts of the SPP published by the policymakers and experts involved in the policy process; (3) articles published by researchers; (4) interviews with several important SPP policymakers.

We choose in our analysis the John W. Kingdon's Multi-Stream Model of agenda setting, which is widely used as an analytical framework for general public policy studies. The Kindon Model maintains that the three independent streams, i.e., problem stream, policy stream, and politics stream together create the windows of opportunity, and result in the agenda setting. The authors make detailed case studies of agenda setting process in the three milestone SPPs mentioned above. In this paper we present the case study of the SPP "National Action Scheme for All Citizen's Scientific Literacy".

We analyze the three streams as follows: The problem stream: (1) The bi-annual surveys of national citizens' scientific literacy (SL), which started in China in 1992, revealed that average level Chinese SL was too much lower than that in the developed countries, which was believed to be a major hindrance to the modernization of China; (2) The FLG incidents occurred in 1999. It was reflected that one of the major reasons was low level of citizens' SL including particularly lack of scientific spirit.

The policy stream: The USA Project 2061 which aims to improve the SL for all American in 76 years, the cycle of the Halley Comet, was introduced into China in 1998 after the top leadership of the China Association of S&T (CAST) participating the 150 years anniversary of the AAAS. The leadership underwent policy learning, forming the idea of long term plan, the Project 2049, similar to the Project 2061. CAST also sought legitimation for the project proposal from the national development strategy, and from the Chinese Communist Party's documents. CAST sent the project proposal to the CCPCC and State Council in 1999; however CAST did not get the official replies from the Central Government till 2002. During this period, supported by CAST, the books concerning the Project 2061 had been translated and published in China.

Political Stream: during 2000- 2001, the key newspaper of the CCP and the Government such as the Peoples Daily published many articles, urging for improving the national SL. The top leaders of the CCP and state councils also delivered talks about SL. The vice Premier in charge of national Science and education held a meeting about science popularization in Nov 2001, and a participant from science popularization community mentioned that CAST did not get the relies to the project proposal on SL from the State Council. The vice Premier asked to check the issue as soon as possible and in February 2002 the State Council agreed CAST together with other ministries jointly to make the policy. The agenda was finally and officially set.

The authors think the Kindon Model is appropriate to analyze complex agenda setting process. However, three streams were not independent as Kindon Model assumed, rather they were connected and interacted in the Chinese context. Thus, we modify the Kindon

Model as: The problem stream, policy stream and political stream interact and contribute together to the agenda setting. We also find that there are different policy cultures in the SPP agenda setting and policy making in China. The four cultures (political, economical, scientific, and civic) interact, cooperate and compete in the agenda setting and policy making process.

A Manifesto for Re-information: Re-scripting Intellectual Property through Ewriting Theories and Practices

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Abstract. Ewriting (electronic writing) generates theories, practices and computer applications that evolve and continuously redefine our perspective on writing. Ewriting tools will challenge deep-rooted cultural habits at the base of our language and thought processes. In a foreseeable scenario, writing would proceed through networking so that every word sequence, every newly conceived phrase would immediately reverberate through net bases, causing responses in diverse formats. As planetary net-integration evolves, ewriting processes will make so much use of data structures that invention will normally be thought of as and realized through re-invention or co-invention. However, legal theories and legislations ingrained in almost unchangeable statutes restrain emerging collaborative authorship models and practices. But if the vision of writing as a socio-machinist planet-wide process prevails, current intellectual property values and legal theories will need to readapt.

Keywords: Authorial processes, ewriting, authors' rights; intellectual property, re-information

Science, Emotion and Objectivity

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Abstract. Is scientific literacy helpful for the objectivity of thought? Human thinking is very important for almost everything in human life. However, what I think is not always right! Our thinking is not healthy, nor good enough in many cases. It is easily twisted and contaminated by many factors. One of them is human emotion that is not properly controlled, but rather prompts us to react to people, events and situations, before trying to think. How can we solve this problem or make progress in human thinking in the right direction?

In our daily life we see a lot of violence, but we don't even recognize it as violence. We are prone to perceive it as honest expression of opinions. Furthermore these days human emotion gets a lot of attention and importance. However, the order in the process of thinking is important since emotion is to be responsive, not to think and lead. If we are controlled by our feeling without thinking we will make a lot of messes in our lives. Even when we face something that prompts us to react emotionally we have to be able to stop to think first and then respond. We have to learn how to think and respond properly. For that, we need to be objective in seeing things.

In science, we try to find a hidden logic and sometimes this requires our intelligence and patience. We wait and think, trying to find a "why?", and understand the reason behind things. Here our mind is objective, not subjective. This is a good thing about science study and education. We can learn objectivity from science. And we can form an objective attitude without being emotional more than necessary in the course of studying science. I see many people say they are rational and fair in their thinking and they really seem to believe themselves to be that way. But when they have to make a decision or express their opinion toward a controversial issue in society, they easily become emotional and their opinion is affected by their feeling relating to their former experiences or personal benefits, and they make a decision that is not rational, nor objective but very subjective and biased by personal experiences. Many cases that become violent and disruptive have an inception that is emotional. Emotion has a lot of energy, so it needs to be controlled properly. And one of the best ways to steer emotion is the objectivity of thinking. Where can we obtain the objectivity of our thinking and how is it possible to make this good habit our new nature?

Science can be a good teacher for us to learn how to be objective in thinking. Natural phenomenon shows us some truth that we approach with a sound mind and patience to figure out what is hidden. In this process we use our mind in a way that is objective. The motion of the sun, the moon and other planets reveals their faithfulness to not change their patterns haphazardly, but follow certain rules continuously. This is just one simple example. There are numerous things that are logical and orderly, so we can learn wisdom and a fair mind from natural science. Science makes us think intelligently, deeply and patiently. Through its training we can develop our thinking ability and how to be emotional properly. Then we can be protected from a lot of emotional violence.

Scientific literacy should affect people to be objective, intellectually honest, and morally right.

African Science Heroes

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Abstract. African Science Heroes, a poster, film, and biographical narrative on the triumphs of African scientists, serves two primary purposes: to empower budding young African scientists by describing innovative possibilities that can be achieved in any walk of life and to document the legacies of African scientists. This presentation will describe the development of the book, film, and posters for African Science Heroes and the engagement and response from African students. African Science Heroes was the product of a fellowship at the Centre of African Studies, University of Cambridge, on the Public Understanding of Science in Africa.

The lack of recognized, publicized African science role models negatively impacts on the ambitions of young Africans and has serious implications for their self esteem. This project celebrates and demonstrates what can be achieved regardless of economic hardship, war, gender discrimination, and racism. It has ensured a space in history where nothing currently exists that pulls together tales of remarkable African scientific accomplishments. It challenges the stereotypical image of Africa as a continent of hunger, disease, war and poverty. These stories of success have motivated young scholars by providing pioneering science role models. The films and posters have been shared with audiences in the Malawi, Kenya, and the UK.

The collection celebrates the remarkable achievement of 15 African scientists (11 men and 4 women). The scientists featured are from varying disciplines - from nuclear physics and nanotechnology to immunology and computer engineering. They all originate from Sub Saharan Africa with a majority of them living and working in Africa. They were been identified through peers, awards lists and science periodicals. The common thread in these stories is triumph over adversity.

African Science Heroes stand for triumph over adversity and the personal values of sustained hard work, extraordinary imagination, and unfaltering dedication.

Science and Technology Communication through Community Radio

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Abstract. Radio has always been a powerful medium of Communication in India. By late 20th century, even before the advent of private and commercial radio channels, All India Radio had a reach of about 80% of the Indian masses. Listenership was somewhere between 40 % and 50 %. Now even after the advent of so many radio channels, the listenership of radio has increased only marginally. The reason varies from increase in population to advent of television, satellites, internet and other means of communication. However radio communication stands alone, since it may be the only means of communication in difficult times like power failure due to cyclones, earthquakes and other similar disasters.

Community radio catering to the needs of a few lakhs of listeners in the coverage area, can be of great help considering the regional, linguistic, religious and socio economic divides in a vast country like India. Reaching the unreached community, radio can also help in communicating scientific and technological advances to the underprivileged. Moreover by its very nature, participatory programmes can be arranged, since community radio can reach listeners in their own language, address their immediate local problems and suggest solutions. Education is spreading it wings everywhere and the real benefit of education will accrue only when day to day scientific and technological advances are brought to the knowledge of the people and their rights and privileges are understood by them. Community radio can be very effective because of the familiar language, easy reach, participatory nature and effective interaction.

In this connection, the experience of Kongu Community Radio or rather its achievements in science communication to rural people will be an eye-opener. Right from its inception six years ago, Kongu Community Radio has been incorporating scientific and technical programmes for the benefit of the listeners. A daily programme supported and catalysed by RVPSP division of DST, Govt. of India, “Science for Women’s Health and Nutrition” addressed the health problems and disseminated valuable information to the listeners, and ran for over one year. Another project supported by the same agency entitled “Understanding Planet Earth” has been running for more than 6 months enlightening the listeners the origin, glory and the threats to the Mother Earth. Not to be left behind in understanding the technological advances a series of 8 episodes on “Chandrayaan” was launched from the day on which the vehicle landed on the moon.

The episodes highlighted the evolution of rocketry, satellites, moon and space probes and the Indian spectacle of Chandrayaan explaining in simple language the nuances of space probe and space technology. Further, programmes on most important scientific discoveries through the ages are broadcast in lucid and simple style for the benefit of even illiterate listeners. Apart from this, awareness programmes on health, nutrition, pollution, global warming etc. are conducted and broadcast in suitable radio format for the benefit of school children and other listeners.

The Science Communication can cut across frontiers and reach the society effectively through Community Radio broadcasts.

Keywords: Community radio, Science communication, Participatory broadcasts

Introduction

All findings, inventions, innovations and achievements of science and technology have to be essentially directed towards the well being of the global society. With the entire world becoming a global village, the thrust areas of scientific and technological research is rightly becoming increasingly focussed towards the well being of the human race. Until the later part of twentieth century, most of the nations have been concentrating on protecting themselves from external threats and defence look the centre stage in their economy and expenditure. The scene has changed now, with most of the countries realizing the need for global cooperation and global protection. Any scientific or technological progress has to have its underlying focus on global issues for achieving this goal. Not only Nations, but individuals, groups, educational institutions, village, town and city administrations and governments also will have to make collective efforts in proper anticipation, planning and execution. The developing countries like India, are focussing their attention on how science and technology can address global issues like natural disasters, global warming, energy conservation, new and renewable forms of energy, nuclear cooperation, space exploration among others. It is the inherent duty of everyone from ordinary citizen to top government executive to ensure that any local issue also will have to be tackled keeping in mind the global repercussions. The saying "Think globally and act locally" has to be the watch word for everyone.

Today, the so called "Fourth Estate" does not denote print and press media alone. Technological advancements in TV, Radio and other electronic media including internet, mostly due to satellite communications, also come under the umbrella of Fourth Estate.

Community Radio (CR)

Radio has always been a powerful medium of communication in India. By late 20th century, even before the advent of private and commercial radio channels, All India Radio had a reach of about 80% of the Indian masses. Listenership was somewhere between 40 % and 50 %. Now even after the advent of so many radio channels, the listenership of radio has increased only marginally. The reason varies from increase in population to advent of television, satellites, internet and other means of communication. However radio communication stands alone, since it may be the only means of communication in difficult times like power failure due to cyclones, earthquakes and other similar disasters.

Community radio catering to the needs of a few lakhs of listeners in the coverage area, can be of great help considering the regional, linguistic, religious and socio-economic divides in a vast country like India. Reaching the unreached community, radio can also help in communicating scientific and technological advances to the underprivileged. Moreover by its very nature, participatory programmes can be arranged, since community radio can reach listeners in their own language, address their immediate local problems and suggest solutions. Education is spreading it wings everywhere and the real benefit of education will accrue only when day to day scientific and technological advances are brought to the knowledge of the people and their rights and privileges are understood by them. Community radio can be very effective because of the familiar language, easy reach, participatory nature and effective interaction.

CR in India

Community radio in India is a relatively new entry in the field of communication. Through the ultimate aim of establishing several thousands of CR stations has not yet been achieved, to-day there are only a little less than 100 community radio stations in India. This has to be compared with more than 6000 community radios even in less populated countries. The reasons are multifold, but some of them are worth mentioning. The fierce competition for setting up profitable commercial radio stations, the hesitation on the part of stake holders in investing on a not too attractive venture in terms of revenue investment, fear of the sustainability, fear of adherence to the policy rules and regulations for CR in India, lack of awareness on CR and its usefulness are some of the major inhibitions forestalling increase in the number of CR stations. But it can be gainsaid that quite a few community radio stations in India are living up to the expectations of the Government of India.

The first Prime Minister of India, Pandit Jawaharlal Nehru wanted Indian citizens to develop what he termed as "Scientific Temper". Ever since Independence, Science and technology has shown a steady growth, though the impact has not reached million of people in the country and it is imperative that effective communication is necessary to carry forward the message of science and technology to their own place of living since most of them have little opportunity to go elsewhere and get information. In this respect CR stations can play a vital role in effectively communicating information regarding science and technology. Though this may not be the only or primary function of a CR station, it can serve the purpose at the grass-root level reaching the under-informed.

Impact of CR Stations in Tamilnadu

Among the Community Radio stations on air in India, Tamilnadu tops the list with more than 18 stations. In fact the first CR in India started its broadcast way back in 2004 at Anna University, Chennai followed in Tamilnadu by Kongu Community Radio at Kongu Engineering College, at Perundurai near Erode. Anna

Community radio started its scientific broadcasts targeting women's health and nutrition which went on air daily for 1 year with the support of RVPSP division of DST, Govt. of India. The broadcasts brought together women of the coverage area and experts in the field of women's health and hygiene and Anna CR has now embarked on the second phase of the same programme.

Kongu Community Radio, functioning from Kongu Engineering College situated in a village in real rural surroundings, also look up a project on "Science for Women's Health and Nutrition" again with support from RVPSP division of DST. The programmes saw participation of women in capacity building workshops, content development, awareness programmes, with guidance and advice from experts in the field. The programme which ran for 1 year successfully has helped to build a strong listeners' base for community radio. The station is now broadcasting a series of episodes on "Understanding Planet Earth" again with RVPSP support. It has helped listeners to understand several aspects of earth, right from its evolution, upto the present day state of the earth. These programmes have been successful in creating awareness on the dangers and disasters facing the earth and the possible ways of combating natural and man-made disasters. All these programmes saw active participation of variety of people mostly women from all walks of life.

Another community radio operating from PSG College of Technology, Coimbatore for the past 3 years has also made impressive progress. PSG Community Radio, through situated in an industry-heavy urban area has been playing a major role in disseminating vital information on community health, global warming and other socially relevant programmes. Currently PSG CR has launched its "Understanding Planet Earth" programme with the guidance and assistance from RVPSP division of DST, Govt. of India.

CR from Holy Cross College, Trichirappalli has also been involved in broadcasting socially relevant programmes which have become popular among their target group of listeners. There are quite a few other community radio stations in Tamilnadu which are providing the science and technology inputs required for their respective catchment areas. In this way the community radios have been playing a major role in disseminating scientific information needed for the particular section of the society in their coverage areas.

Organizations like Commonwealth Educational Media centre for Asia have been providing yeomen service by educating, monitoring and evaluating the performance of CR Stations. It will not be out of place to mention here that realizing the unavoidable expansion of community radio stations in India, the Indira Gandhi National Open University (IGNOU) has launched some courses on "Community Radio". Community radio has also entered the curriculum of Rajiv Gandhi National Institute for Youth Development (RGNIYD) in all their post graduate programmes with a few credits. This Institute also runs Ilanthalir Community Radio from its campus for youth development. Surely, the concept of CR is taking roots in India.

Kongu CR and Science Communication

Apart from DST supported programmes on Science for Women's Health & Nutrition and Understanding Planet Earth, coming back to the efforts taken by Kongu Community Radio in popularizing science and technology, mention has to be made of a few of its programmes. A programme on science and technology popularization called Arivial Paarvai (Scientific Vision) is being broadcast every Sunday for the past 4 years regularly, touching upon the various aspects of science and technology. A series of 8 episodes on India's prestigious space probe "Chandrayaan" was broadcast from the day on which the Moon Impact Probe of Chandrayaan landed on the moon. These episodes highlighted the advances in space probe by different nations of the world, the need for such explorations and finally the aim and achievements of the Indian space venture "Chandrayaan". Based on these episodes, a book entitled "Science Reaching the sky: Chandrayaan" was released. The copies of the book were distributed at World Classical Tamil Conference held at Coimbatore in June 2010 to the delegates who attended the session in which the Project Director of Chandrayaan Mr. Mayilsamy Annadurai delivered a lecture. In an ongoing programme, most important scientific discoveries right from the days of Archimedes are being broadcast every week to enable listeners to appreciate the significance of important scientific discoveries in all fields. More than a hundred discoveries will be highlighted in this series. Efforts are on for bringing out a compilation of all these episodes in the form of a book.

Awareness Programmes

Apart from this broadcasting activity, Kongu Community Radio has been in the forefront in organizing awareness programmes for school children and villagers, on health, nutrition, eye and dental care, HIV AIDS, climate change and global warming. The station crews of Kongu CR have been consistently engaged in taking the message of science to the masses directly, by arranging special programmes and lectures for school children and others. In this aspect, about 3000 school children and 300 teachers have benefited by Kongu CR’s outreach programmes on climate change and global warming. All India Radio’s Kodaikkanal FM radio, the most popular radio channel in Tamilnadu went on air with exclusive live phone-in programmes on "Global Warming and Climate Change" one of which had the station-in-charge of Kongu CR as its expert presenter. Kongu CR has provided inputs on science and technology to the television channels also highlighting scientific advancements, global warming, natural disasters among other things. Radio professionals from BBC, AIR, Doordarshan, China Radio Tamil Service and dignitaries from USA, Korea, China, Canada, apart from officials, educationists and enthusiasts from all over India, have visited the studios of Kongu CR and appreciated its efforts in enlightening the community.

Kongu CR also has trained radio professionals and media persons. With the assistance of Chennai wing of Internews Network, a 7-day workshop on “Emerging issues in HIV testing” for radio professionals in Tamilnadu was held at Kongu CR station. Another programme on “Role of Media in Earthwise Living” was organized for local media professionals and reporters. Nature walk by school students was successfully organized to inculcate love of nature in young minds. Video clippings, posters and handouts emphasizing the need to protect the beauty and nature of earth were profusely used to create awareness on energy saving and global warming. Many of the programmes emphasized the ways in which the problems should be addressed and tackled. Feedback and responses received and surveys conducted have shown appreciation for these programmes.

Conclusion

Community radio stations can definitely help in taking the concepts of science and technology to the common man and can involve them directly because it is the only channel through which one to one correspondence can be established. The only constraint today is the inadequacy of number of CR stations in India. When more CR stations are established and if each CR station broadcasts at least 20 % of its programmes for popularization and communication of advances in health, science, technology and agriculture, it should be possible to effectively transmit useful information to listeners throughout the country. If every willing citizen is able to participate in well organized programmes, community radios can effectively cut across barriers, reach the people from nook and corner and communicate advances in science and technology in all relevant fields like education, agriculture, environment and energy.

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Involving Experts and Citizens on Climate Change Debate. The European Project Accent

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Abstract. Climate change issues are clearly a growing concern for the public today. In recent years, people have received a great deal of information from media on the causes and consequences of climate changes, but–depending on countries and regions–the understanding of citizens and their engagement in these topics is still varied. Communication professionals are making effort to communicate the messages correctly. This presentation proposes to contribute to a global effort to develop news tools and actions on climate change from "informative" to the "active" procedures through the exchange and dissemination of practices that involve citizens in actions and dialogue.

In my talk I will start taking into consideration some recent data on European public opinion. Secondly, I will introduce the Accent project (http://www.i-do-climate.eu/), an initiative promoted by a group of 12 European science centers proposing "active procedures" of involvement on the issues of climate change. The science centers are using "active procedures": hand-on exhibitions, participative games, local citizens forums and many others, in order to engage effectively the public in such themes.

The central point in this presentation is the promotion of two-ways communication channels between the scientific community and the public. Specific attention will be given to the participation of scientists and the role of science centers in the development of communication tools and programs for the choice of scientific topics and for correct and clear information to the non-expert public.

Reporting Science and Technology in Print and Electronic Media

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Abstract. The advancement in communication technology has made a huge growth in media industry and also has given a freedom to set new professional trends. The convergence is apparent in many different ways. Media is growing and flourishing but with this growth many questions are emerging on the credibility of its content and the journalistic norms which print and electronic media are inheriting.

A free market provides opportunities for growth, freedom and confidence to explore new things. Media is not only a great source of information but it also gives us a platform to raise our voice. It is a fourth pillar of the democracy which has the power to ask questions. Media can set new trends by making people as well informed citizens at the same time media has the power to influence public understanding on subjects like science and technology.

Today the world is going through major changes. In such circumstances people should be aware and equipped with knowledge and information which leads them in the direction of self-reliance. Media is the source through which people not only know about the happenings of the world but it also gives them a direction to find solutions of their day-to-day problems.

To get the answers of all these questions, the researcher has done a study of print and electronic media for her PhD with topic "Reporting Science and Technology Communication in print and Electronic Media". It was a content analysis of two mainstream newspapers and Four TV channels.

One of the most important findings of the study was people are very much interested in reading and watching science and technology news/ programs but they are not satisfied with the quantity of coverage being given by TV channels and newspapers to science and technology.

The survey of the school kids, college students and professionals shows that they want a channel devoted to science and technology - based news and programs. They want to see what is happening at world level in the field of science and technology but they are not getting that kind of information from media. It was found in the study that national news channels hardly cover science and technology in news shows.

Channels like Discovery and National Geographic Channels, which show higher percentage of science and technology programs have more information on scientific development around the world but the content of the programs does not match with viewers/ readers requirement for national news.

It is interesting to note that the coverage of science and technology in print media improved over the years, now they are not only giving more space but also publishing special issues on science and technology, it is found in the study that now local news and news from Indian source get more coverage in national newspapers, they are focusing more on positive news stories in comparison to controversial news of science and technology, they also try to explain the subject from scientific point of view and gives more focus to research findings new developments and researches. Media should focus on science and technology news and programs with other categories of news and programs. By including science and technology news in their regular chunk media can help in fostering the scientific attitude and behavior as well as interest towards science and technology.

An assessment of lessons learned in the communication and dissemination of emerging scientific issues to environmental policymakers across Europe

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Abstract. In most developed countries today it is generally agreed that for environmental policy to be effective, the decision-making and actors involved need to be well informed by science. However, communication between science and policy has sometimes been ineffective in the past. The ambition to improve the use of science in policy making processes has much in common with the ambition to increase public participation: to limit inadequately informed and incompletely deliberated decisions, which can result in unnecessary costs, social conflicts and mistrust of the government. Previous research has described how the main barriers to successful science-policy communication relate largely to the nature of environmental science, the nature of policy making, and the gap between them. A number of recommendations for addressing this gap have been described in the literature, which have broadly focused upon: increasing interface between scientists and policymakers; use of translators, advocates and networks; and new skills, tools and roles for scientists.

This research tested the value of these recommendations in real-world policymaking settings from a number of European countries, and set out to develop lessons to improve future activities to communicate science to policymakers. Through a series of five in-depth case studies and four mini-case studies, including climate change and nanotechnology, from different countries across Europe, narratives of the communication issues and recommendations from the literature sources were developed. These were then added to and refined through interviews with the key stakeholders involved and then analyzed to isolate themes and patterns. The findings generated a complex picture of the many factors that affect the ways in which science and research feeds into policy making. Some of these factors echoed the criteria identified in the literature, while others were new and additional. Some factors relate to communication, but a number (and arguably the most significant) relate to wider matters – such as the process by which policy is made and the context within which this process takes place. In particular, the research found that the role of the translator is much more complex than simply explaining science clearly and that the credibility of science was key but easily confused by policymakers with the 'settledness' of science. The importance of moving towards an ongoing dialogue model of policymaking rather than an 'end of pipe' model was also identified as being key, with institutional structures, as much as communication players, enabling this ongoing communication to take place. Finally, we consider what these findings mean for communicating research to the public and whether their role would change in this new dialogue model of policymaking.

Science Popularization of Grass-root NPO

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Abstract. Research on science popularization organization mostly focuses on social organization and NPO with apparent government background, however, discussion on science popularization of grass-root NPO is rare. This paper briefly analyzed the shortcomings of grass-root NPO in the field of science popularization and the reason of being ignored, and proposed some suggestions.

Keywords: Grass-root NPO, science popularization.

Introduction

With the human society entered high-tech period in the 21st century, the rapid development of science and technology not only provides prerequisite for promoting human welfare, but also makes human beings facing severe challenges. Global warming, resources exhaustion, energy crisis and population boom still are obstacles that crossing in the further development of human beings, a single scientist or any country could not cope with them in way of dealing with these comprehensive problems, which needs globally public engagement. However, the prerequisite of public engagement is to promote the scientific literacy of the public, and to make the public fully understand and recognize these problems. How to let them fully understand the urgent problems and at the same time making the public enjoy the benefit of science and technology achievements? The author thought that the broad science and technology practitioners should throw themselves into science popularization to promote the science literacy of the public.

Just as the name implies, science popularization is the activity which takes promotion the scientific literacy of the public as its purpose, is the process of disseminating scientific and technological knowledge and skills which has already being mastered by human beings and science thoughts, science method, science spirit which evolves from scientific practice to every aspects of the society by various ways and channels. From this perspective, science popularization is a social public welfare and also is the system engineering. During the process of promoting the cause of science popularization, association of science and technology, which is the mass organization of China science and technology practitioners, is the important social sectors of promoting science and technology cause by the government. The broad science and technology practitioners who affiliate to the association of science and technology exert great functions in promoting China science popularization causes. However, science popularization is a systematic work involving every sector of the society. To enhance the science popularization work and promote the scientific literacy of the public is an important and basic social engineering, is the necessary content of socialist material civilization, socialist spiritual civilization and socialist political civilization, which is the collective responsibility of our society. Therefore, the overall engagement is the important component part of science popularization work.

The relevant provision of Law of the Peoples Republic of China on Popularization of Science and Technology regulates that State organ, armed forces, public organizations, enterprises and institutions, rural grassroots organizations and other organizations shall work for PST(Popularization of Science and Technology—note by the author). In order to achieve the working mode of Great Mass Organization-Great Coordination-Great Publicity-Great Science Popularization under the guideline of great unity and coordination requires us to integrate various social resources; thus, we should discuss the function of the grass-root non-profit organization, as a sector of other social organization, in the cause of science popularization.

According to different research perspective, different scholars and researchers give non-profit organization (NPO) different definitions. The author believed that NPO is the social organization between government and enterprises that founded according to voluntary principles but not be founded by business purpose to provide various services to the public or exceptive clients. However, NPO in China has its own features due to its dual-management system; the classification of NPO in China also is extraordinary. This paper will not focus on its classification, but pays much attention to the function and strategies of NPO in developing the science popularization and how to enhance NPOs' effectiveness during the cause of science popularization. Wu Zhongze believed that scientific and technological NPOs are mainly formed by scholarly communities of a specific subject, such as various societies. The practical situation is that these societies belong to the scope of social organization, but not including the grass-root NPO.

The Status Quo of Grass-root NPO in Science Popularization

Recent years, national innovation system has already on the agenda of our government, yet as the important component part of this system, the science and technology popularization system bears the important mission of transforming science and technology into practical productivity. In order to reflect the situation of China science popularization and propose suggestions to China science popularization development, since Oct, 2010, China Research Institute for Science Popularization has already being compiled China Science Popularization Report. The relevant charters of the report would introduce the organizations that carried out science population, these organizations in nature belonged to the scope of NPOs, but which had far more government background. This situation reflects that the grass-root NPOs do not attract enough attention in the process of science popularization. The deficiency of grass-root NPOs in science popularization and their lagging research have its intrinsic reason, but also have extrinsic obstacles.

Capital scarcity is the first obstacle of science popularization. According to statistics, there are 191 national societies affiliated to China Association of Science and Technology (CAST), 167 of them are collective membership, which including 41 science societies, 64 engineering science societies, 14 agricultural societies, 22 medical societies, 26 science popularization and interdisciplinary societies. The capital of these societies has a certain guarantee, if we look at to grass-root NPO, their resources of capital is single, most of their capital comes from solicit contributions, donation and foundations. China does not have perfective taxation incentive policy which makes enterprises and individuals would not like to donate, and this further results in a vicious circle of capital deficiency. Taking Beijing Huiling as an example, its capital mostly comes from the grant of foreign foundations. At the same time, its daily maintenance expenditure is very strained.

Shortage of talents results in the inability to make further advances of grass-root NPOs in science popularization. The characteristic of pure public welfare and non-profit making leads them could not attract and retain outstanding human resource through high compensation. The scientific and technological talents with high academic background are inclined to enter enterprises or government departments, which bring about the human resources of grass-root NPOs are marginalized, therefore, they are very difficult to find excellent talents from the personal market. Voluntary group is the indispensable part of providing service of science popularization by grass-root NPOs, however, after careful research, we could find this group could fall into two parts, the first part is students, most of them are being organized by school mass organizations, which brings some difficulties in training and talents cultivation because of their great fluidity; the second part is the successful individuals in other aspects, they get involved in NPOs cause without any expectation of money, but they only could help grass-root NPOs during their leisure time, which means they could not fully take part in the cause. Personnel problem is another obstacle of the development of grass-root NPOs in science popularization.

The narrow scope of grass-root NPOs in science popularization also limits their function. Science popularization system is a comprehensive one, and different science and technology needs different technical talents, however, NPOs could not get the fully human resources that they needs, which results in their limited filed and narrow scope of carrying out science popularization. Most grass-root NPOs have to confine their activities to the much comprehensive but less sophisticated field, for example, they focus their filed on the environmental protection, agricultural industry and sustainable development.

The dual-management system also confines the grass-root NPOs' engagement of science popularization activities. The dual-management system was established by the State Council in 1989, in order to manage the civil organizations. According to this system, any civil organization which wants to take form must find a administrated departments, only after being approved by the administrated departments, can it registers in the civil administration department. This system gives us two hints. The first one is that there are two departments in charging of the registration process, and the approval of the first department is the prerequisite of the second department's approval; the second one is even an organization get approval by the two departments, they still are responsible for different aspects of the organization operation. Therefore, many grass-root NPOs could not find the registration department and subordinated departments, they have to fluctuate between legal and illegal. This also becomes the barrier.

However, the increasing grown number of grass-root NPOs in China like mushrooms after rain shows extraordinary performance in the aspect of science popularization, especially after the Wenchuan Earthquake, a batch of grass-roots NPOs initiatively left for disaster areas, they providing excellent service in assisting the local government in the field of healing the wounded and rescuing the dying. The international society had named the 2008 as China's First Year of Volunteer, which illustrated that the great number of grass-root NPOs had already become an indispensable part of science popularization in China.

When analyzing the science popularization (communication) experience of NPO in developed countries, we could find that purely relying on government could not reach the anticipated results, only giving play to the large-scope characteristic of NPO and carrying out directive science and technology services, could science popularization attract the public engagement and achieve the aim of enhance scientific literacy.

Conclusion

The optimum operation of society needs the well-organized coordination of government, enterprise and NPO, and the construction of science popularization system also needs the cooperation of government, enterprise and NPO. As the important supplement of government and traditional social organizations, the grass-root NPO could further recognize the needs of grass roots, meet the multiple requirements of society, how to exert its function in science popularization is a considerable subject.

First, a benign environment for grass-root NPO is necessary when it carries out science popularization work. Whether the public is fond of science and technology and could engage in it to some extent depends on whether their requirements are fully met. The science popularization activities carrying out by NPO with official background only could meet the middle-level citizens' requirements. So the current dual-management system should be revised in order to extend grass-root NPOs developing space, they should be endowed the official legitimacy, social legitimacy, political legitimacy and legal legitimacy.

Second, grass-root NPO should be encouraged to engage in science popularization activities. Due to various limitation and barriers, entering the field of science popularization for grass-root NPOs is difficult, especially for the activities with strong specialty. Which needs the government support and encourage them to take part in. This kind of encouragement should include cultivate talents, provide capital etc. science and technology talents should be encouraged to find jobs or take part-time jobs at grass-root NPOs, the financing channel should be extended, and at the same time encourage the enterprise and individual to donate through perfecting the taxation policy should be implemented.

Finally, the social climate of absorbing grass-root NPO should be cultivated. The traditional convention of China makes the public form a mind of resistance towards NPO. For them, non-profit organization is non-government organization, so non-government equals to anti-government. This public opinion results in the dilemma of NPO, especial for the grass-root NPO. To create a benign social climate for grass-root NPO during their development and engagement in science popularization is significant, which could give them much time and energy to carry out science popularization activities.

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Mapping "Public Understanding of Science" in China with "Culture Distance"–An Application and Empirical Study of "Culture Distance" Model in China

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Abstract. The present paper in the first section localized and modified the culture distance model with Chinese education level being the control variable, by considering the Chinese civic scientific literacy survey index system and analyzing the latest data result of the 8th Chinese civic scientific literacy survey conducted in 2010. The "culture distance" model of China Public Understanding of Science was attained. The following sections, in detail, dealt with the application of the modified model on data sets collected in 2003, 2005, 2007 and 2010 in China. A comparative analysis was given between different groups and regions on public understanding of scientific knowledge, scientific methods and scientific concepts among Chinese citizens. The divergence and variation trends of public understanding of science were discussed among citizens with different factors such as: gender, education level and location. Suggestions on effectively communicating science in target populations in China were given at the end.

Keywords: **C**ulture distance, Gender difference, Scientific discipline

Introduction

In order to measure the extent of scientific knowledge, probe public understanding towards science and technology, and to explore the level of scientific literacy that a common citizen had in science, surveys have been conducted both in India and China. These surveys gradually turned into an important and regular activity in both countries. A comprehensive database has been obtained. The debate that followed the surveys in these two countries resulted in refinement of methodology and models of assessment of Public Understanding of Science for developing countries. A culturally sensitive model for analyzing the survey data was proposed by the PAUS group at NISTADS in India. It was designed as the "cultural model of Public Understanding of Science" and achieved meaningful results (Raza G, S. Singh, 1995, 2000, 2002, 2004, 2007, 2009). Because of the similar social context, this model was used to interpret and analyze the status of "Public Understanding of Science" in China from a different perspective in this paper.

Adjustment of 'Culture Distance' Model

According to the 8th Chinese Civic Scientific Literacy Survey Index System (CRISP, 2009), there were three secondary indexes included in the primary index 'public understanding of science', which were used to evaluate the respondents whether they had basic scientific literacy: basic scientific knowledge, basic scientific method and relationship between science and society (scientific spirit). In the questionnaire of 2010 survey, the questions with regard to 'public understanding of science' were divided into four categories according to the secondary indexes: (□) science view (C1, C2); (□) science terminology (C3, C4, C5, C6); (□) scientific method (C7, C8, C9); (□) scientific spirit (C10, C11). Of these categories, there were eighteen questions on science view under C1 and C2, which included five domestic questions and thirteen international questions; three international questions and one domestic question with multiple choices on science terminology under C3-C6; three questions on scientific method under C7-C9; and in the category of scientific spirit, five questions were included under C10 and one question in C11 which was a choice-question. In this paper, nine questions considered as core indicators for international comparison were chosen for analysing ‘science-view’ and three science terminology questions (‘molecule’, ‘DNA’, ‘Internet’) were chosen on public understanding level of basic scientific knowledge. According to the scientific knowledge and information that respondents needed to understand each question and give correct answer, these twelve questions were divided into six disciplines, which were ‘biology’, ‘geography’, ‘engineering’, ‘physics’, ‘medical science’ and ‘chemistry’ (see Table 1).

Table1. Question classification

Scientific Knowledge	Biology	C1-3. It is the mother’s genes that decide whether the baby is a boy or a girl. (d)
		C2-5. Human beings, as we know them today, developed from earlier species of animals. (a)
		C4. “DNA”
	Geography	C1-1. The centre of the earth is very hot. (b)
		C1-5. The continents on which we live have been moving for millions of years and will continue to move in the future. (c)
		C2-9. It takes one day for the earth to go around the sun. (f)
	Engineering	C5. “Internet”
	Physics	C2-6. All radioactivities are man-made. (e)
		C2-7. Lasers work by focusing sound waves. (h)
		C2-8. Electrons are smaller than atoms. (g)
	Medical Science	C1-4. Antibiotics kill viruses as well as bacteria. (i)
	Chemistry	C3. “Molecule ”
Scientific Methods	“scientifically research”(C7), “Comparative experiment”(C8), “Probability”(C9)	
Scientific Spirit	“Science and Superstition”(C10), “Science and Personal Behavior”(C11)	

Since data could only be analyzed in terms of bi-variate response variable with culture distance model (Raza G, S. Singh, 2007, 2009) and question types of the four categories were different from each other, standardization was carried out in the dataset before analyzing. The nine questions on science view were mainly simple statements of scientific information and the responses were solicited in terms of ‘True’, ‘False’ and ‘Don’t know’. ‘True’ indicated that the respondent knew the correct answer and ‘False’ meant s/he did not know the correct scientific explanation. ‘Don’t know’ was recorded as incorrect response. The three questions on science terminology were closed questions. Two options of each question were considered to be the correct answers, which indicated that the respondents understood the terminology, and the other two were recorded as incorrect response. The three questions on scientific method were also closed questions. Only one option of each question was considered to be correct, which indicated that respondents fully understand the method, and the other three were recorded as incorrect response. The response 'do not believe' to the five questions under C10 and the response except 'pray to god bless' to C11 were considered to be correct answers, and the rest responses were recorded to be incorrect.

During the survey all the respondents were instructed to record their education attainment to relevant level. The education level was converted into years of schooling at the time of analyzing the dataset as continuous control variable. For example a response 'primary school' was recorded at the time of interview and converted into 6 years prepared for data analyzing (see Table 2).

Table2. Education scale in China

Education	Illiterate	Primary school	Middle school	High School	College	University
Number of Years of Schooling	0,1,2	3,4,5,6	7,8,9	10,11,12	13,14,15	16,17

With the standardized dataset, dichotomous curves could be plotted for each question in Table 1 and values of cultural distance for each question could be computed. In order to get the values of cultural distance of six scientific disciplines listed in Table 1, values of questions under each discipline should be weighted mean using the following equation.

$$V_i = \sum V_j \cdot \frac{k_j}{n_j} \qquad (1)$$

Where,

V_i is the culture distance value of each scientific discipline

V_j is the culture distance value of each question

k_j is the number of respondents who gave the right answers to the question*

n_j is the number of respondents who were interviewed in the survey*

*For different group, k_j and n_j are different.

It should be noted that k_j/n_j is the coefficient of each question for different groups of respondents. It could reflect the degree of complexity of each question for different groups of people. For each scientific discipline, the coefficient indicated the weight of related scientific knowledge or information implied in each question under this discipline for certain specified cultural group or a subgroup. With this equation, culture distance values of different scientific concepts of different groups of people could be computed.

Contrastive Analysis on culture distance based on 2010 survey in China

With the adjusted model described before, based on the dataset of 2010 survey in China, the culture distance values of general respondents and different groups were obtained. Contrastive analysis among the four surveys that had been conducted in China in year 2003 (China S&T Indicators, 2004), 2005 (China S&T Indicators, 2006), 2007 (China S&T Indicators, 2008) and 2010 and between various groups, such as male and female respondents, and respondents in different regions, were carried out in the following part.

Culture distances in general

***Cultural distances of science-view*:** As shown in Fig. 1, the culture distance values differed greatly among the nine questions. 'The theory of evolution' (a) was placed closest to the quotidian life of Chinese citizens with the values being 3.7 (2003), 3.6 (2005), 4.2 (2007).and 5.3 (2010).

'Antibiotics kill viruses as well as bacteria' occupied the farthest end of culture distance scale. The values of cultural distance were 18.2 (2003), 19.2 (2005), 16.7 (2007) and 17.9 (2010). Here we can notice a sharp rise in culture distance values of 'earth revolution' (f) between 2007 and 2010. The reason for this increase may be located in the expression of the question which might have easily confused respondents between rotation and revolution of the earth. The culture distance values of other questions remained almost the same over the years with minor fluctuations.

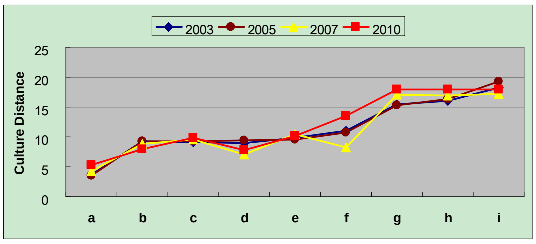

Figure 1. Culture distances on science view of the four surveys in China

***Culture distances of scientific terms*:** The culture distance values of 'DNA' and 'Internet' decreased on the whole, whereas the culture distance value of 'Molecule' visibly increased over the years (see Fig. 2).

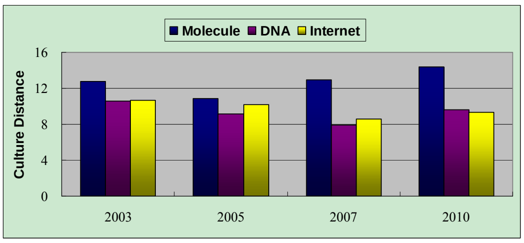

Figure 2. Culture distances of scientific terms of the four surveys in China

The results reflected that compared to 'Molecule', 'DNA' and 'Internet' stayed closer to Chinese citizens' quotidian life. People intended to seek more information about 'DNA' and 'Internet' use in daily life and work.

***Culture distances on scientific methods*:** From Fig. 3, we can see that the culture distance values of 'comparative experiment' and 'probability' stayed at a certain level over the years with minor fluctuations. But an obvious raise could be noticed on the culture distance value of 'understanding of 'scientifically research'' from Fig. 3. Science communicators in China should pay attention to this phenomenon.

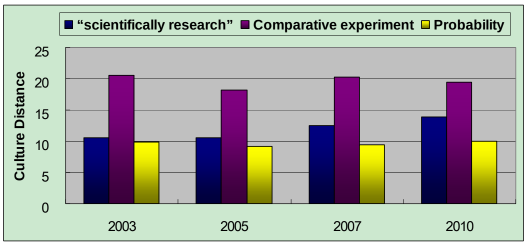

Figure 3. Culture distances on scientific methods

The culture distance values of the two parts on scientific spirit decreased over the years (see Fig. 4). 'Science and personal behavior' stayed much closer to the quotidian life of Chinese citizens than 'science and superstition'. It showed that Chinese citizens' personal behavior in their daily life became more scientific. Promoting science over superstition through science popularization needs to intensified in China.

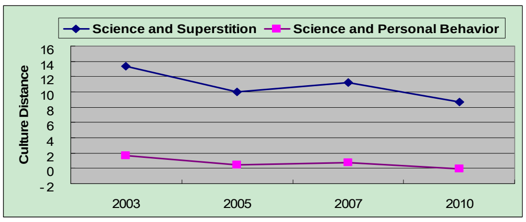

Figure 4. Culture distances on scientific spirit

Culture distance of gender groups

The culture distance values of the six

scientific knowledge disciplines of male and female respondents were computed with adjusted cultural model stated above. The results showed that scientific knowledge and information about biology stayed closest to the quotidian life of both genders with the scores being 7.3 (male) and 7.7 (female) (see Fig. 5). Information and knowledge about medical science placed at the longest culture distance scale. For male and female respondents the distances were 18.6 (male) and 17.5 (female). The other four disciplines occupied the places between these two extremes along the culture distance scale, which were geography (9.9 for male, 11.3 for female), engineering (9.1 for male, 9.5 for female), chemistry (14.0 for male, 14.9 for female) and physics (14.3 for male, 16.9 for female) in ascending order according to their culture distance values. It could be noticed that the culture distance values of all the scientific knowledge disciplines of male respondents were lower than that of female, except that the culture distance value of medical science of female respondents was lower than that of male and universal sample. We can also see that the gaps of culture distance values between male and female on geography and physics were obviously bigger than the other four. The reason to these two phenomenons might be the difference in structure of mind of these two gender groups. Men were more likely to absorb and accept knowledge and information with strong logic like physics and geography, but women prefered to get information and grasp knowledge related to health and personal care. So in order to make science communication effectual for different gender groups, different transmission methodologies with a focus on specific content should be formulated according to knowledge structure needs of male and female.

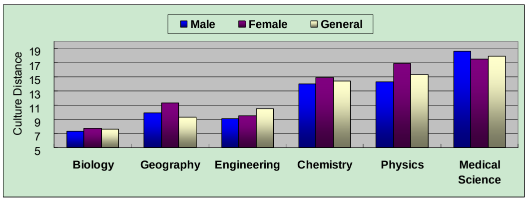

Figure 5. Gender difference on scientific knowledge

The culture distance values of ‘scientific knowledge’, ‘scientific methods’ and ‘scientific spirits’ of male and female respondents were also computed with the adjusted model. It could be seen in Fig. 6 that the culture distance value of female on scientific methods was lower than that of the male and general. The culture distance values of male-scientific-knowledge and spirits were lower than that of female and the latter one was much lower. The reason could be attributed to low level of exposure to scientific method which women get in traditional societies. Special effort should be made in promoting scientific spirits among female group.

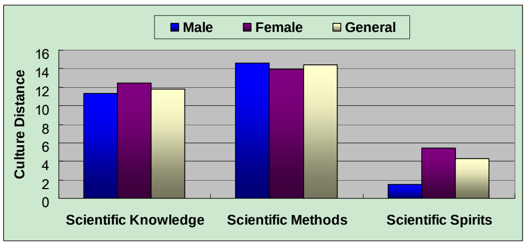

Figure 6. Gender difference on understanding of science

Culture distance of various provinces

Using the national representative data collected in 2010 survey, culture distance values of questions in Table 1 could be computed for all the thirty-two provincial units in mainland China. According to RCDI (National Survey Research Center at Renmin University of China, 2008), thirtyone provinces in China were divided into four categories. For the present discussion two provinces from each category were selected (see Table 3). Beijing and Shanghai represented the region which had the highest comprehensive development level across China. Jiangsu and Jilin were located in the coastal area, which were less developed than the first category. Shanxi and Chongqing represented the region which had the middle comprehensive development level and were also located in central China. Yunnan and Qinghai belonged to the least developed category which were located in western China. Values of different scientific disciplines for each of these provinces were computed with adjusted model. Values of scientific knowledge for each selected province were also computed (see Table 4). Subsequently, all the eight provinces were ranked on the basis of their cultural distance from each of the six scientific disciplines. Value 1 was assigned for the lowest cultural distance and 8 occupied the outermost end (see Table 5). In the following paragraphs an effort has been made to present the salient features of the rank distribution.

Table3. Eight provinces selected according to RCDI

Categories	Provinces
□	Beijing, Shanghai
□	Jiangsu, Jilin
□	Shanxi, Chongqing
□	Yunnan, Qinghai

The relative position of cultural distance for all the disciplines remained nearly the same across each province. For all the eight provinces, ‘biology’ could be placed at the shortest cultural distance and ‘medical science’ could be placed at the farthest end. In between, the value of cultural distance for the other four disciplines i.e. ‘enginnering’, ‘geography’, ‘chemistry’ and ‘physics’ increased progressively. For example, Shanghai, which belonged to category□, ranked the first place in scientific knowledge with the value of 10.0, the computed values of biology, engineering, geography, chemistry, physics and medical science for Shanghai were 5.9, 8.5, 8.8, 12.3, 13.6, 13.9, respectively. Correspondingly, for Yunnan which was much less developed than Shanghai, scored the third place in scientific knowledge, and the respective values of the six disciplines were 6.9, 8.4, 9.8, 12.9, 14.5 and 15.9. Though there was a big gap in comprehensive development level between Shanghai and Yunnan, the differences of cultural distance values of scientific knowledge and six scientific disciplines were small (less than 2) between these two provinces. Another example, still comparing with Shanghai, Beijing which was on close level of comprehensive development with Shanghai, ranked the sixth in scientific knowledge with the value of 11.7. And the corresponding values of the six disciplines for Beijing were 6.6, 8.3, 9.7, 15.4, 16.4 and 23.5. Big gaps could be seen in cultural distance of certain disciplines such as medical science (almost 10) between Beijing and Shanghai. These showed that the culture distance of different area was not directly related to its comprehensive development level. It also showed that people’s level of understanding for each scientific discipline varied greatly among provinces.

It should also be noted that absolute values of cultural distance for various scientific disciplines varied a great deal across provinces. Jiangsu scored the lowest on cultural distance scale for physics with the value of 13.3, and Chongqing scored 19.2 for the same scientific discipline. Jilin was placed at the largest cultural distance for chemistry with the value of 20.4, where as, for Shanghai the score of chemistry was quite low, i.e. 12.3. It is evident that using this adjusted model, if a province was taken as the reference point, the cultural distance of each scientific discipline could be mapped and strategies to bridge the cultural distance for each category of scientific knowledge could be devised.

Table4. Relative cultural distance of the selected Chinese provinces

	Biology	Engineering	Geography	Chemistry	Physics	Medical science	Scientific knowledge
Beijing	6.6	8.3	9.7	15.4	16.4	23.5	11.7
Shanghai	5.9	8.5	8.8	12.3	13.6	13.9	10.0
Jiangsu	6.2	9.0	9.1	13.8	13.3	17.3	10.5
Jilin	8.2	9.1	10.9	20.4	16.1	>25	11.3
Shanxi	7.5	9.3	9.1	15.0	15.1	18.2	11.5
Chongqing	9.1	10.2	12.6	16.0	19.2	18.4	13.9
Yunnan	6.9	8.4	9.8	12.9	14.5	15.9	10.9
Qinghai	7.9	9.7	11.0	16.6	16.6	18.1	12.6

Table5. Ranking of provinces based on cultural distance

	Biology	Engineering	Geography	Chemistry	Physics	Medical science	Scientific knowledge
Beijing	3	4	1	5	6	7	6
Shanghai	1	1	3	1	2	1	1
Jiangsu	2	2	4	3	1	3	2
Jilin	7	6	5	8	5	8	4
Shanxi	5	3	6	4	4	5	5
Chongqing	8	8	8	6	8	6	8
Yunnan	4	5	2	2	3	2	3
Qinghai	6	7	7	7	7	4	7

Conversely, if we take a scientific discipline as the reference point, then various provinces could be placed at varying degree of cultural distance. For example, in order to democratise the knowledge of biology, Shanxi will have to travel a longer cultural distance compared to the population of Yunnan, Beijing and Jiangsu. Thus, it could be concluded that the strategy to communicate knowledge of biology to the people in Jiangsu may not work in Yunnan or Shanxi. In other words, if a scientific notion was to be democratised among a province, specificities of their cultural-cognitive-structure would have to be taken into account. It could also be pointed out that with the adjusted cultural distance model, differences in structures of people's cultural mind in different areas could be probed. Scientific notions placed at large cultural distances were not expected to become a part of the people's cultural thought through short term solutions. Thereby, suited and effective measures could be adopted by local science communicators referring to the analytical results presented here.

Conclusions

The adjusted model well described the status of public understanding of science in China in a different perspective. It is evident that based on this model index for measuring level of public understanding of science could be constructed without declaring sections of society as 'scientifically literate' and 'scientifically illiterate'. It also evidently reflected the scientific awareness level of different gender groups and areas for different scientific concepts. As the level of complexity increases the relative cultural distance, of scientific phenomenon, tenet or information, from the quotidian life of populace also increases. Using the model relative culture distance between various scientific notions and people's structure of thought in quotidian life were mapped among genders and areas. Based on these maps, strategies for effective communication of science, specific to various cultural groups and different areas, can be formulated.

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Construction of PUS Index in China–An Empirical Study on the Database of China 2010 Civic Science Literacy Survey

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Abstract. This paper is concerned with an empirical study on the database of 2010(the 8th) Civic Science literacy Survey of China. By learning from latest theoretical achievements of relevant scholars and considering the features of Chinese practice, the author extracted a Model of China Public Understanding of Science(PUS) Index from the latest Civic Scientific Literacy questionnaire .The constructed China PUS Index contains 5 indicators as following: Knowledge (public knowledge of S&T), Attitude (public attitude toward S&T), Interest(public interests in S&T), Engagement (public engagement of S&T)and Information (the information channels of S&T). Confirmatory factor analysis (CFA) accompany with other relevant statistical methods, was applied to evaluate the validity of this Index model. Under the framework of China PUS Index, the Author profiled several characteristics of China public understanding of science at present stage, and provided an open platform for further comparative study under different social and cultural contexts in PUS field.

Keywords: Public understanding of science, Confirmatory factor analysis (CFA), PUS index

Introduction

Since the Scientific Literacy of Chinese citizens was firstly carried out in China 1992, how to assess the level of civic scientific literacy, as the core content of previous investigations, remained as the focal point by people of various circles. Using the percentage to show public Science literacy level has shown significant limits already, which has been in application since the first survey in China. On one hand, the duality logic by which to assess whether a respondent obtains a qualified level in scientific literacy or not, is a rather arbitrary evaluation. At the meantime, the duality logic was on the loss of gradate information in scientific literacy level of respondents. On the other hand, by the percentage method can only get a simple category variable from survey results, which can hardly support the in-depth follow-up data analysis.

For the above, during the data analysis course of the seventh survey of Chinese Public Scientific Literacy (2007), the research group created the Chinese Public Scientific Literacy Scientific Index (CSLI). The CSLI index integrated a number of core indicators of scientific literacy into a single form. The CSLI index stands for the total score of all the correct answers in tested questionnaire for a respondent, while for groups the CSLI index shows the weighted average scores of every individual in the group. Compared with the percentage result, the introduction of China Scientific Literacy Index has several advantages as following:

(1) The adoption of all respondents reply information improved the efficiency of survey data application.

(2) Survey results will be adopted as a continuous variable, which can support the division of citizen's scientific literacy level to be more accurate.

(3) Provide a basis for integration of 'public access of science and technology information indicators, 'public attitude towards science and

technology' indicators and citizen science literacy indicators.

In 2010, the sample designing for the 8th scientific literacy survey of China was based on the population in mainland China, while take 32 provincial-level units in mainland China for the sub-population. In each provincial unit a three-stage stratified sample of the PPS was applied. To take provincial units as sub-population for sampling was designed on biggest advantage to describe the situation of each provincial unit and to enable comparative study on provincial level. The index system in 8th survey followed the major structure of previous surveys. The core questionnaire was composed by three parts: 'public science and technology information sources', 'public understanding of science and technology', 'public attitude towards science and technology'. Some relevant static indicators were also including in the questionnaire such as: gender, age, education level, district, social groups, professional and some other background variables. This paper intends to extract a Model of China Public Understanding of Science (PUS) Index from the latest Civic Scientific Literacy questionnaire. With reference to the CSLI index and the international model of PUS, the China PUS index has also been combined with the questionnaire items related to the PUS content

Selection of Indicators

In fact, the 'public understanding of science' model is taking PUS index as a complex has strong-related with the public interest, knowledge and positive attitude toward science and technology. However, it becomes a priori definition: one has the 'scientific literacy' only if he expressed a 'certain level' of interest on science and technology, obtains "adequate" S&T knowledge and holds a 'positive' attitude towards the role of science and technology.

Based on the questionnaire and the follow-up data analysis principles, we defined the model of the Chinese public understanding of science index in five dimensions ,including scientific knowledge, attitudes, interests, participation and information indicators. As for the five dimensions, there are 8 items from former scientific literacy indicators to make up of scientific knowledge, 6 items about interests in the interests dimension, 12 subjects formed the participation indicators, 4 items for the informness index, 4 attitude indicators involved in the formation of attitude indicator.

Scientific knowledge dimension is the base of the model of public understanding of science. Taking the feasibility for international horizontal comparative analysis into account, we selected nine items from the questionnaire (two knowledge items in the survey conducted in China were combined) which already widely adopted in PUS surveys, the specific as follows: (Table 1)

Table1The construction of Knowledge indicators

knowledge	Item
k_earth	Geocentric temperature is very high.(C1_1)
k_around	It takes one day the earth to turn around the sun .(C2_9)
k_oxygen	The oxygen for breathe comes from plants. (C2_2)
k_gene	It is mother's gene to determine the gender of kids. (C2_3)
k_electron	Electron is smaller than atom.(C2_8)
k_antibiotics	Antibiotic can kill virus.(C1_4)
k_continents	Millions of years, continents have been slowly drifting, and will continue to drift (C1_5)
k_evol	So far as we know, human being is evolved by early creatures. (C2_5)

Public interest in science and technology indicators made up by the respondents interests in six topics, including: new scientific discoveries, new inventions and technologies, new medical advances, agricultural development, industrial technology development and conservation of resources and energy.

Limited by the difference in ways of questioned, information sources dimension was mainly through the participation in S&T activities of the respondents during the last year as pay visits to the popular venues and science popularization activities.

Cos of there was not directly address the degree of the public awareness of science and technology information in latest questionnaire, we took how citizens participate in scientific and technological affairs as items to constitute an informness degree approximately. According to the respondents experience in taking part in the S&T affairs and business including: talking about technology topics, participating in technology-related discussions or hearings related with atomic energy, biotechnology or environmental topics, the extent of public S&T informness dimension was constituted.

There were quite a lot of items including in the questionnaire on the attitude dimension. To avoid too many interference items in this dimension, we applied the factor analysis on all of the attitude items and two main factors were selected from two topics. (Table 2)

Table 2 Rotated Component Matrix (a) on attitude indicators

Public attitude towards S&T	Component	
	1	2
Modern science and technology will provide more opportunities for new generations.	.748	.057
Scientific and technological progress will help to treat AIDS and cancer and other diseases.	.667	.143
Science and technology do not solve any problems we faced.	.025	.711
Continuous application of technology will eventually destroy our planet.	.186	.664

Finally on each dimension we get an indicator with its value range and the code of score for each item was given in Table 3.

Table 3 value for each indicator

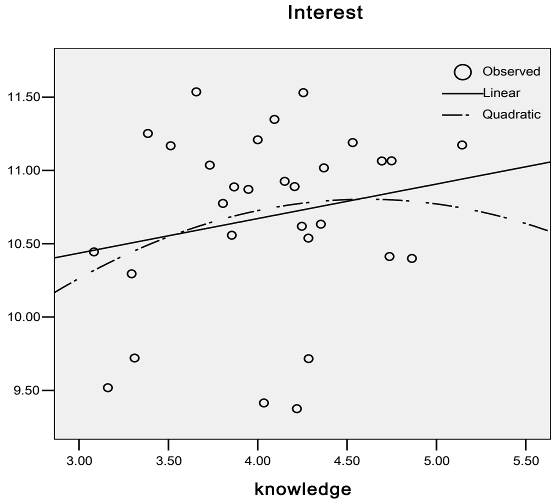
indicator	code	value
knowledge	1、0	[0,8]
interest	3、2、1、0	[0,18]
participation	1、0	[0,15]
informness	3、2、1、0	[0,12]
attitude	2、1、0、-1、-2	[-4,4]

Indicator Analysis and Construction of Index

After the Correlation Analysis between knowledge indicator and other 4 indicators, we found the standard assumption of linear relationship in PUS model showed some interesting phenomenon. Mapping the correlation with the fitting curve equation, we get the relationship between knowledge and other 4 indicators. (Data stands for each provincial unit)

Knowledge and interest

Although citizens in each province may vary a lot from their interest in science and technology, science literacy level has no obvious correlation with interest. So the interest on S&T may come from the influence of the local media environment rather than the knowledge level.



(Figure 1)

Figure1: Correlation between Knowledge and Interests

Knowledge, engagement and informness

Public Engagement in S&T means the frequency respondent visited S&T popularization venues in last 1 year to assess the extent of public participate in science and technology activities. Knowledge and engagement indicators are in line with the linear relationship assumption. It means that people with high level of S&T knowledge usually participate in science and technology activities, visit science and technology venues more frequently. According to Figure 2, the right axis of knowledge indicator shows that people from major cities and some developed provinces in eastern part of China visit to science and technology museums and participate in scientific activities more frequently, while people from western part of China has lower frequency of engagement in S&T activities. This phenomenon indicates the uneven distribution of public resources in science and technology popularization in China currently.

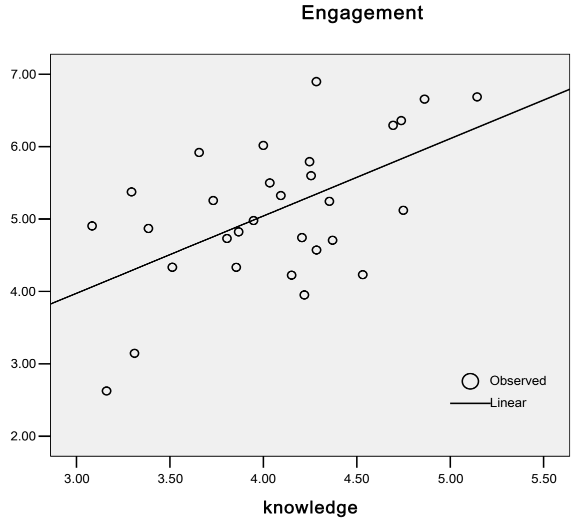


Figure 2 correlations between engagement and knowledge

The informness indicator in China PUS index stands for the extent of involvement of people in science and technology affairs. We can tell from Figure 3, the correlation between knowledge indicator and informness indicator is also consistent with the linear hypothesis.

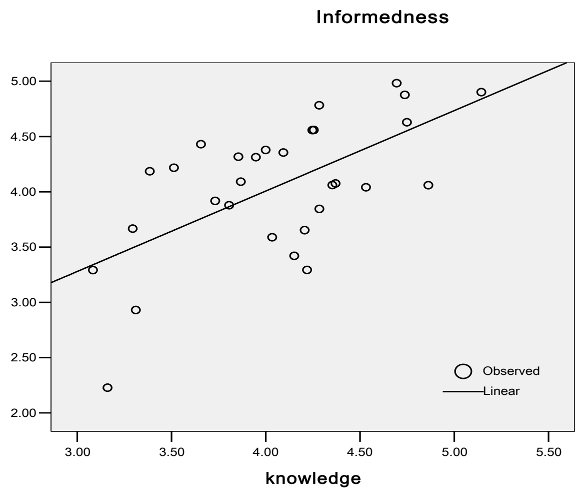


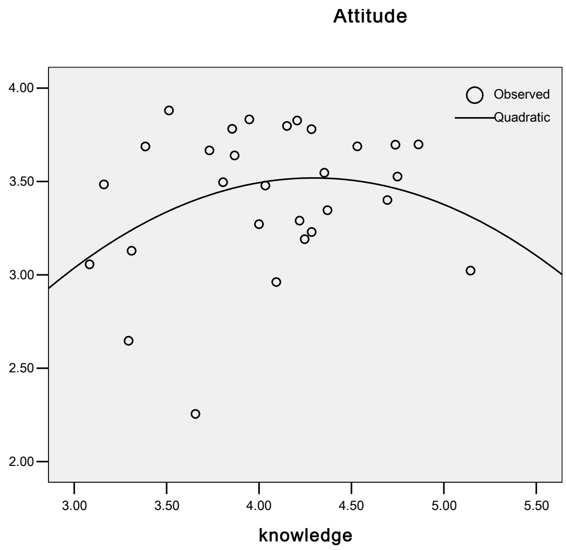
Figure 3 correlations between knowledge and informness

Knowledge and attitude

The ‘two cultures’ model in PUS research shows that only in a specifically circumstance, the interests indicator, knowledge indicator and attitude indicator will be in strongly positive correlated. The mutual correlations were significant impacted by level of industrial development of the regional environment within a certain range. (Bauer, Durant & Evans, 1994; Bauer, 1993)

In industrialized societies knowledge indicator has a positive correlation with positive attitude, while in post-industrialized societies the relationships among knowledge, interest and attitude have great difference from industrialized societies. Especially, the correlation between knowledge and positive attitude was no longer as we got from industrialized social background. This is also the key argument from ‘two cultures’ model theory.

Among provinces of China the relationship between knowledge and attitudes also showed a similar law. Under a certain level of S&T knowledge level, people with higher level of scientific knowledge tend to obtain the more positive attitude toward science and technology. When people’s knowledge level exceeds the certain range, attitudes and knowledge will show an opposite relationship. By nonlinear analysis, we found that the separation point for the ‘two culture’ groups is the point which knowledge score 4.3and attitude score is 3.5. It can be concluded from figure 4 that on the both sides of separation point the relationship between attitudes and knowledge showed totally opposite result. According to further comparative data analysis, the developed provinces in eastern part of China and special municipalities showed the PUS characteristics of post-industrial society, while the western region near the border areas showed characteristics of industrialized society.



Separation point P(Y=3.52 x=4.3)

Figure 4 nonlinear analyses between knowledge and attitude

Because of the nonlinear correlation of knowledge and attitude indicators, we need do linear transformation on knowledge and attitude value before get the final formulation of PUS index.(Figure 5) Here is the relevant mathematical conversion:

Ki stands for the score of knowledge value of the ith (i=1 , 2 , …,32) province ; kp stands for the knowledge value of separation

Attitude= Attitude if ki<=kp

Attitude = 2*Attap - Attitude if ki > kp

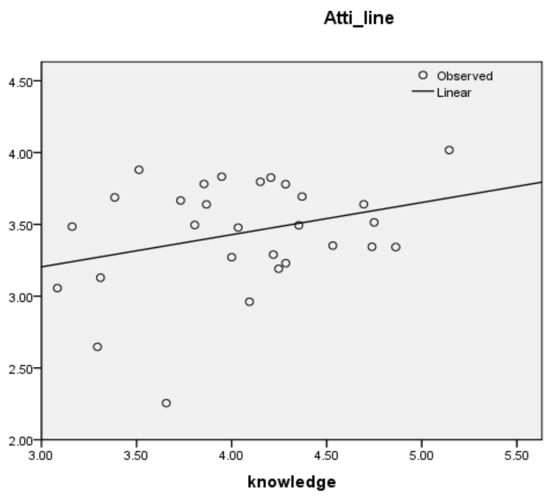


Figure 5 Correlation between knowledge and attitude after liner transformation

Chinese public understanding of science index and validation test

As already discussed before, we already made it clear on the composition of public understanding of science index and the correlation between each indicator with scientific knowledge. As for built up the index formulation, we need to determine the coefficient of each indicator. These factors reflect the importance for each dimension to the total score.

In this paper, the index coefficient was determined by factor analysis method. The factor loading coefficient shows each factor's contribution to common factor, and the variance contribution ratio stands for the extent of common factor's representative to all sample variance. Therefore, the result of factor loading coefficient multiply with variance contribution stands for each indicator's contribution in the whole sample. The contribution of each index divided by the contributions of all the indicators can get the weight of each indicator; the formula is expressed as：

$$\omega_i = \frac{\sum_{j=1}^{m} \beta_{ji} e_j}{\sum_{i=1}^{p} \sum_{j=1}^{m} \beta_{ji} e_j}$$

$$(i = 1, 2, \cdots, p \quad j = 1, 2, \cdots, m)$$

At last we get the formulation for China PUS index as follows：

PUS=0.1612*Knowledge+0.1211*Attitude+0.1014Interest+0.2394Informedness+0.2465Engagement

After get the result of PUS index and average scores of PUS index in mainland China, we classified 3 groups in mainland china respondents (by two-step cluster analysis),the characterize of each group was shown in Talbe4.

Table 4 cluster analysis of PUS index in Chinese citizens

cluster	Mean	SD	gender	Education level	Rural/ Urban	Region
1	2.23	0.87	More female	Primary	More rural	western
2	4.56	0.67	average	Medium	average	average
3	6.96	0.91	More male	college	More urban	eastern

Cluster analysis by pus index can largely profile the distribution of the various background variables. This result of cluster analysis generally meets the actual situation in China and shows the selection of pus indicators is reasonable.

Conclusions

Due to space limitations, this paper can not make further discuss on the formed PUS index and make abundant analysis by applying this PUS index. There are all sorts of method on subjective attitude measurement theory, while each country and culture has its own characteristics and complexity. Based on the eighth survey of Chinese citizens' scientific literacy, we applied a more accepted index for public understanding of science under international circumstance to Chinese practice for the first time. Then the research group tried to construct a new evaluation index on Chinese public understanding of the science. At present, we can conclude some key features for Chinese people from PUS index result. To get more accurate analysis and valuable conclusion, further improvement in the index system and in-depth data mining are very necessary. We expect this discuss can lay a solid foundation for PUS index research in china and open a new platform for international comparative research.

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Developing Countries and Information Deficiency

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Abstract. We sometimes suffer from Information Deficiency (ID) in everyday life. We can find the Information Deficiency similar to vitamin or mineral deficiency problems faced everyday by people who lack of good nutrition. When someone is short of vitamin A, we find them suffering from several physical symptoms such as color blindness etc. The doctor may diagnose it as vitamin A deficiency and prescribe an extra dose of it. Similarly, when someone suffers from Information deficiency, we find them not working optimally or unable to address an important problem and solve them. We can cite several interesting examples of information deficiency at several levels. A person may have a PC but may not know how to connect to the internet and access the email. Another example can be that of a computer that may not have the right update to the antivirus and thus can become vulnerable to latest virus threats.

Information deficiency can be sometimes thought about as opposite to Information Overload. Information overload is availability of excess information and inability to find time or energy to process it. There is so much of literature on Information Overload on the internet. I think Information Deficiency is distinct from Information overload. Even in presence of Information overload, a person may suffer from information deficiency. Information deficiency arises out of unavailability of useful information at right time and right place. The value of information thus is space-time related. The value of Information becomes judged based on the demand it has and its time criticality. How much urgently a piece of information is necessitated.

Recently, I went to a newspaper vendor and wanted to buy a paper. The paper vendor told me all the newspaper issues with him were sold out. I asked him the reason. He told me the reason was the headlines, i.e., a bomb had exploded somewhere and people were eager to read about it and know about it. We can see that people want to cover the Information deficiency created by a news item and seem to rush to find out more through newspapers, internet, television and various other mediums. The suspense created in a terrorist attack or plane crash or tragedy connected with earthquake or volcanic eruption etc create information deficiency syndrome among people temporarily. Few days later, when I went to buy the newspaper with the same vendor, I could see him having lots of unsold papers. As the headlines were less dramatic and were unable to trigger an appetite among the public for more information, the interest in buying the news papers had diminished.

We see the Information deficiency playing a vital role in software industry. Do the software engineers have the right information to build the applications or systems their customers are demanding? This is the question addressed in the requirements phase of the software project. Information deficiency in a software project can lead to delayed project schedules, misunderstood customer requirements, software malfunctions etc. During interviews for software jobs, we can observe the interviewer assessing the prospective candidates potential for information awareness. If the candidate is suffering from information deficiency, and the interviewer is smart enough to examine it through questions, surely it will go a long way in selecting right people.

In Universities and Institutes, we find the students preparing for examinations and tests. Their preparation indirectly is to cure their information deficiency. Another place we see the information deficiency playing a vital role is the quiz competitions. Surely, quiz participants need to be well prepared in order to be successful in a quiz contest.

Information deficiency is predominant in other professions too such as medical, legal, etc. Lack of information about medicine or diseases, can be leading to increased fatalities in hospitals. Information Deficiency plays a vital role in healthcare and medical world. The spread of new kinds of diseases brings in a challenge for diagnosis, treatment etc. The doctors and patients face a situation of Information Deficiency regarding diagnosis, treatment, symptoms, drugs etc.

In the developing countries, we find information deficiency playing a vital role due to several factors such as lack or limited telephone and computer networks, frequent power outages, inadequate infrastructure, higher patient to doctor ratio, illiteracy, etc. An effort to improve the information availability and literacy will have significant impact on the overall health and wellbeing of population.

Science Communication an important tool for Science Popularization: A Case study of Uttarakhand Council

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Abstract. Uttarakhand is formed on 9th November, 2000 as the 27th state of the country after separation from Uttar Pradesh. The state is often called as "the land of Gods or Dev Bhoomi" because of the presence of Charam Dham (Badrinath, Kedarnath, Gangotri and Yamunatry) and bestowed with rich natural resources i.e. forest, rivers, flora , fauna etc. State is 80% hilly and having tough terrain and frequently affected by the natural clematises. In this condition it became very difficult to provide the good education facilities to the inhabitants especially in Science, in which lot of explanation (practical) is involved. In order to boost the scientific temper among the masses of the state, Uttarakhand State Council for Science & Technology (UOST) started functioning in June, 2005 at Dehradun as a nodal agency of Department of Science & Technology (Govt. of India). The important mandate of Council are:
(1) Research & Development
(2) Science Popularization
(3) Entrepreneurship Development Programme
(4) Himalayan System Science.

In the present paper an attempt has been made to highlight the indicatives taken by UCOST for creating Science awareness through Science Communication. Since its inception a large number of campaigns (Planet Earth, WASH, International year of Astrology, International year of Biodiversity etc.) & large number of workshops (Intellectual Property Rights (IPR), Water Testing, Technology demonstration, Role of print and electronic media in science communication, etc.) related to different issues of Science & Technology were organized by Council in every corner of the State through agency SPECS (nodal agency of Council for Science Popularization in Garhwal), PAHAL (in Kumaon) and District Coordinators. As per the analysis approximate 15,000 inhabitant i.e. Students, Researcher, Scientist & Common masses etc. were benefited in various issue of Science & Technology. It is concluded that by proper planning & action plan, Science Popularization can be archived, which can improve the socio-economic status of the state.

Keywords: Science communication, Science Popularization, UCOST, Campaign and Uttarakhand

Lazy Expertise vs. Lay Expertise: The Construction and Bias of China's Health Knowledge

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Abstract. China has dedicated itself for the health knowledge popularization for years. But the top-down diffusion of knowledge mode by means of professional expertise seemed to get limited performance. On the contrary, the public are disposed to give all their trust to the lay expertise.

Efficacy of Using Drama Techniques for Science Communication

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Abstract. This paper will focus on the use of Drama Techniques as a provocative and engaging methodology in creating background for efficient science communication and discuss its usage in the classroom, training environment, and the community. The paper will also explore how this unique educational tool can facilitate personal growth, raise consciousness, and initiate behavioral change. The components of the techniques and examples of effective use will also be discussed.

Keywords: Drama techniques, Science communication, Russia

Introduction

Though Drama Techniques are quite developed in the world they nevertheless are misunderstood in the country of prosperous theatre (Russia). Mostly they are regarded as the process of acting and role playing. But they are more than that.

Another obstacle here in Russia is considering communication among scientific societies to be more important than the relationship of science to the broader public. The Education Ministry (pre-school, primary, secondary, college education) is expected to fulfill the role of connecting the public to science. At the same time there is a tendency to desystematize the traditional way of educating which peaked in quality 20 years ago and then brain washing and anarchy in the wake of the USSR fall and now new reforms seeding chaos, disrespect and consumerism in impressionable youth.

In addition, TV broadcasting, computer games and the internet are forming a new rhythm of information perception - impulsive, based on bright, quickly changing elements. New educational tools are required to meet the demands of the generation to follow which finds no use in some science subjects at school.

As we see here, Russian traditional education is almost extinct, while the new one is still developing, and at this stage it is quite urgent to discuss the efficacy of science communication which cannot exist without the proper educational background.

Drama Techniques are about working with rhythm, ways of appealing to participants and carrying them away into reflection, communication, thus improving them in different aspects.

Efficacy of science communication is rooted in circumstances shaped, modeled and organized by drama techniques:

A positive mood influenced by drama techniques can boost one's positive acceptance of science communication.

Through its spontaneity and emotional intensity, Drama Techniques can focus attention, heighten awareness of scientific knowledge importance. Well-scripted curricula with emphasis on practical applied science might boost students' interest in details, profound learning and participating in science communication.

Gradual encouragement will boost students' confidence in ability to understand complicated scientific material.

Methodology

Population and participants

The study was conducted at the Udmurt State University with students of historical, philological and journalistic faculties. The population sample included 200 students learning English. The students who participated in the pilot study were not science-communication-oriented. By exploring Drama Techniques in teaching English to draw students into the world of science, a positive outlet for science communication was provided.

Instrumentation

This qualitative study evolved through the collection of the students' responses to
the nine-month inclusion of the Drama Techniques for an efficient science communication program by examining the students' writing samples, formulating for pre- and post-interviews and making observations.

General Assumptions Regarding the Drama Technique for Efficient Science Communication

1. Initially, the students will pull away from learning science as an academic subject which puts them in a negative mood, but as a part of an English class in which they are interested,

learning English as means of International communication, including communication dealing with science.
2. Some of the class days will be extremely emotionally charged, due to the peculiarity of the program appealing to the nature of most humanitarian students.
3. Due to the transient nature of the university and placements into the program, there will be some changes in the room's makeup during the period of time in which the study takes place to plunge them into some "scientific realities" (observatories, labs, museums…).
4. Students will enjoy the dramatic games and exercises included in the curriculum starting a new stage in science communication.

Provocative and engaging methodology

Drama Techniques might be characterized as a provoking and engaging methodology to appeal to participants and carry them away into reflection, communication, thus improving publics, and students particularly, in different aspects.

Generalizing we may define several strategies to make a well-script of the class:

- warming up with guessing, pre-quiz, wordsplash, free associations, evocative quotation, photo, movement, sound, scenario or song dealing with the topic of the lesson (most of them are aimed on the one hand to provoke them to think, get involved into activities, focus on the theme, on the other hand they help to understand any misconceptions or preconceptions that the students may have about the subject to plan further work more efficiently):
- breaking barriers with physical touching, whispering, leveling… games;
- increasing self-confidence stimulating to communication with compliment training, assuring games, support activities, recalling personal successes, unique skills, loving relationships, positive momentum;
- opening mind to hear more, learn more, analyze more with activating extra-listening skills, introducing word-games (anagrams, paronomasia…) dealing with the themes.

Creating background for efficient science communication

First of all, what is science communication**?** Generally, it involves some discussion of science with non-scientists, but those who make it are not necessarily scientists; they can have different backgrounds, so the term is usually applied to more 'public-facing' work.

Why do we need science communication? Writing in 1987, Geoffery Thomas and John Durant describe the various reasons for increased Public Understanding of Science as follows:

- Benefits to Science–This is the 'to know is to love' argument, and perhaps mixes up the word 'understanding' with 'appreciation'. It suggests that increased PUS will lead to more funding, looser regulation and more trained scientists.
- Benefits to National Economics–This argues that to compete economically we need trained scientists and engineers, which more PUS will provide.
- Benefits to Individuals–This is based on the sense that we live in a technological society, and assumes that we must know some science to negotiate it (e.g. knowing about surface tension helps us kill spiders).
- Benefits to Democratic Government & Society as a Whole–This train of thought emphasises that a scientifically informed electorate equals a more democratically run society.
- Intellectual, Aesthetic, and Moral Benefits–These arguments assume science is good for the soul in some way and increased PUS will lead to a populous of happier and more fulfilled individuals, perhaps equating science with the arts or religion.[1]

But at the same time, writing in 1952, I. Bernard Cohen points out a set of 'fallacies' in arguments for improved science education:

- Fallacy of Scientific Idolatry–'believing scientists to be lay saints, priests of truth, and superior beings who devote their lives to the selfless pursuit of higher things'.
- Fallacy of Critical Thinking–understanding science does not necessarily give you this transferable skill, as 'may easily be demonstrated by examining carefully the lives of scientists outside of the laboratory'.
- Fallacy of Scientism–science is not the best or only way to solve problems.
- Fallacy of Miscellaneous Information–'the belief in the usefulness of unrelated information such as the boiling point of water, the distance in light years from the earth to various stars, the names of minerals'.[2]

The process of popularization is a form of boundary work to benefit without fallacy.
In the US, Jon Miller differentiates between identifiable 'attentive' or 'interested' publics (i.e. science's fans) and those who do not care much about science and technology. Working in a particular surrounding we have to see one's publics have the following four attributes of scientific literacy:

- Knowledge of basic textbook scientific factual knowledge.
- An understanding of scientific method.
- Appreciated the positive outcomes of science and technology
- Rejected superstitious beliefs such as astrology or numerology.

Answering these questions we may find the ways to reach efficient science communication.

But what is efficient science communication?

There are five main components which are implied meaning efficient science communication:

- Dialogue
- Engagement
- Respect for audience and context
- Science and how it matters to society
- Scientists as key actors

Drama techniques are the tools encouraging, catalyzing and facilitating the process of starting and maintaining dialogue making people engaged and respectful for the audience. That's the beginning to the following question we refer to.

Ways of creating background for efficient science communication.

"In this fast-forward world, nothing is more critical than how and what you communicate…"–Dr. Denis Waitley, author of "The Psychology of Winning"

In our case both (how - efficiently, what – science) are beyond criticism. The subjected is the way of creating background for efficient communication, particularly – Drama Techniques. The stage is educational institution, classes of English. Unfortunately, a lot of students in Russia distaste learning science as an academic subject, it puts them in a negative mood. But what if we engage them into a science dialogue as a part of an English class in which they are interested. Through its spontaneity and emotional intensity, Drama Techniques can focus attention, heighten awareness of scientific knowledge importance. Well-scripted curricula with emphasis on practical applied science might boost students' interest in details, profound learning and participating in science communication.

Gradual encouragement will boost students' confidence in ability to understand complicated scientific material.

Results of the Study

Most students have got engaged in science communication by reading more about science, demonstrating a high level of readiness for science communication. There are some more particular facts illustrating the growing of their interest in science communication.

Some students from Journalistic Faculty have got interested in writing articles about science. Some students of historical faculty have decided to participate in the intellectual game "What? Where? When?" challenging them to learn more in the world of science. Some of the philologists have made a scientific project for the local library to embrace more people into the world of science communication.

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A Comprehensive Survey on Frequent Pattern Mining from Web Logs

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Abstract. Web usage mining is the type of Web mining activity that involves the automatic discovery of user access patterns from one or more Web servers. As more organization rely on the Internet and the World Wide Web to conduct business, the traditional strategies and techniques for market analysis need to be revisited in this context. Organizations often generate and collect large volumes of data in their daily operations. Most of this information is usually generate automatically by Web servers and collected in server access logs. Other sources of user information include referrer logs which contains information about the referring pages for each page reference, and user registration or survey data gathered via tools such as CGI scripts. In this paper we have surveyed various applications of web usage mining and analyzed their productivity.

Keywords: Web usage mining, World Wide Web, Data mining, Web mining

Can independent and Qualified Science Communication Survive in a Time Dominated by Institutional Interests?

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Abstract. Quality control for research has been performed by independent academic journals. This system is under threat because competing universities and libraries fighting for their mission are reacting in ways that have negative consequences for those journals. Governmental intervention can secure their continued existence but probably at the cost of the loss of academic freedom.

Keywords: Academic journals, Libraries, Quality control, Science communication, Universities

Introduction

Quality control by peers

For many centuries quality control for research has been performed by peers and published in free and independent journals. This system functions as a gatekeeper to ensure suitability of the published manuscripts.

The work is made under the supervision of editors that often are chosen from the best researchers in the respective field. For each submitted article their job is to find the best experts on the article's topic and have them—often two—to give their opinion about the article in a long row of questions about its originality and precision in its presentation of the subject, and the validity of the theories and the data behind and its theoretical discussion in the international research society. At last they give their judgement: yes, perhaps, or no to publishing. Often the answer is "perhaps" and the author has to improve the manuscript.

After this process accepted articles go through another quality process where the language is edited and made precise, with working illustrations, proof reading, lay out, keywords, control of references and much more.

Indeed, the peer review process has secured the progress of research. Consequently, articles that have been published in such journals have served as a reliable source because journalists could trust the quality.

The quality process made in freedom

This system is managed by independent journals and publishers. The expenses for the editorial process have been paid for centuries by selling the journals to subscribers with a little support from a society or fund.

Under this system, the editorial process has been carried out independent of institutions, universities and the state bureaucracy, functioning as pretty near the ideal to secure "the truth" with a very long arm-width away from politicians and administrators. Often 70 per cent or more of manuscripts submitted are rejected regardless of who the authors are or with what institution they are associated.

This is very important for the development of science when this judgement is carried out away from institutional and political interests. The other quality systems in the academic world—the examination of students and the employment of teachers and researchers—is made in the institutions, which are often a battlefield of different institutional and political interests.

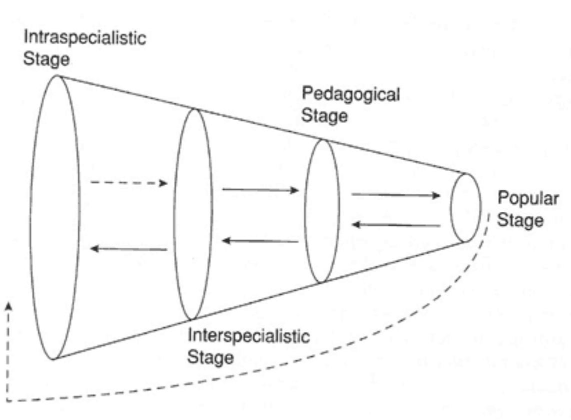
The perfect public communication process

This quality system has been the background for the process for the public communication of research. The communication process is not directly from the researcher and to public in a linear model but through several steps in a communication process.

This process is described by Bucchi (1998).[1] As seen in the illustration, the intraspecialistic stage refers to peer reviewed academic journals. The knowledge is published in journals intended for scientists from all disciplines, such *Nature* or *Science*. The next stage is the pedagogical stage with textbooks and popular science journals, and at the end we have the popular stage with TV programs, newspapers and other mass media.

This ideal communication system ensures that the information in the popular stage is trustworthy and valid because it has been through the quality process.

[1] Massimiano Bucchi: *Science and the Media - Alternative Routes in Scientific Communication*. London & New York 1998.



The Threat From Universities

Bypassing the quality process

Unfortunately, this communication system has changed over the past decade. The communication often happens directly from the researchers (or their institution) and to the popular stage as shown in the bypassing large arrow.

At first it could look like an improvement: more research to be published. But when information jumps over the quality process in the peer reviewed journals, the information is published on the conditions of the popular media. It is obvious that the journalists in the tabloid press are not interested in the academic truth or able to judge anything about the quality of the information. They have only one goal, gathering information for a good story.

Therefore we will have a lot of stories about new science breakthroughs that will give cures against cancer and new optimistic forecasts about the enormous potential, fantastic possibilities, and the next industrial revolution.

Of course the popular media always had this goal of a good story, but when news comes from academic journals the information was neutral and not marketed with more power than information from other articles in academic journals.

New administrative steering instruments

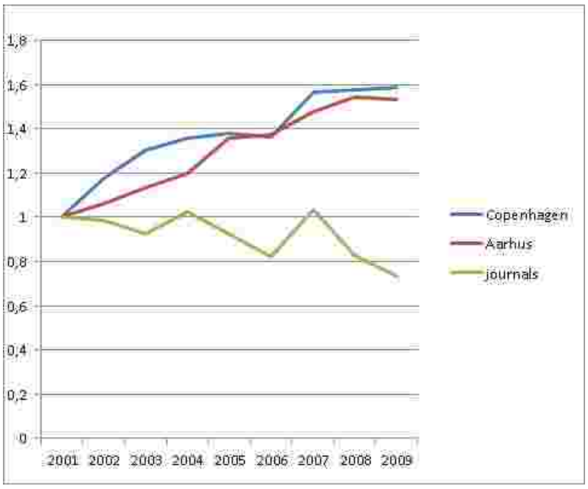
Today, strong institutional interests result in attempts to bypass this system in order to highlight themselves. Regrettably, these institutions are universities.

For example the press coverage in itself is a positive factor. In the performance contract between the Science Ministry and the University of Copenhagen, this measure was counted by the citations in the newspapers. In 2008, the measurement of the success showed an increase of 5 percent.

Please note that there is no effort to track the quality of this press coverage. The object is solely to have a higher number in one of the most popular steering instruments for administrators—the spreadsheet.

The development is the same at all Danish universities. The focus is massive at the managerial level at the universities, and the results are obvious. The diagram below shows the development of the mentions of the universities in Copenhagen and Aarhus compared to the mentions of the Danish top journals in leading newspapers.

The increase of press coverage is enormous for the university stories and the coverage of news through the academic journals is stable or has a tendency to decrease.



Strengthen of institutional interests

This institutional egocentrism exists at the expense of the interests of science itself. The attempts at self-promotion are rooted in various causes.

Foremost the universities are in strong competition with each another. Students are choosing universities based on many factors. Also, universities compete for the best teachers, attention from politicians, and access to large funds.

In an attempt to gain a competitive advantage, universities are arming their information departments with journalists and other communications experts. Those new members of the bureaucracy are trying to sell their institution to the mass media and convince them of their particular university's value and superiority. By using in-house media experts to market directly to the media, these universities are short-circuiting the academic quality control process, given that they bypass a review by independent editors.

Consequences for the academic journals

The bypass is not aimed at the university managers but an unintended result of a longer development. The universities are "businesses" with the claim from the governmental administration that they have to be managed by professional management persons.

In Denmark this development was stated by a new university law in 2003 and after that each headmaster, head of a faculty and head of department was appointed by the board and not by his or her peers.

University policy about the learned journals has changed. They are desirable institutions but instead more of a burden.

The examples from the contemporary history of journals are many. For example, the journal *Tidsskrift for Arbejdsliv* is ranked in the official list of improved academic journals. Its chief editor is from the *Danish University of Education*, some articles are written by researchers from the university, and the journal is used in the education and research at the university. The university does not support the journal—it had to pay a high rate to have its editorial address at a university; in fact, the university does not even have a subscription to the journal. The central institution in relation to the journal has used large sums of money to create its own journal to promote its own researchers.

This story shows the disinterest in journals and activity directly against the journal content. Many editors are asked to stop their work for cross institutional journals; it is well known that academic journals have difficulty attracting qualified editors.

The Threat From Libraries

The destruction of journals

This chapter will discuss a policy with a rather calculated aim to destroy the publishers of academic journals. Seen from the perspective of the journals, they are presented by political demands to put their articles free on the Internet without compensation. This demand is made by powerful governmental institutions that are trying to force the researchers to follow this policy.

The economy of the journals is affected by this policy because until now the income from the journals has come from selling subscriptions and copies. Therefore the journals will miss its economy to pay for expenses for the editorial process.

The result can be catastrophic for the academic world. In 2007, one Danish research council demanded that the journals it supports should publish their articles for free after one year after publication.

This mandate had serious consequences. One of the journals lost 25 per cent of its subscribers in two years. It had to cut its editorial expenses and reduce the numbers of pages by 20 per cent.

Not all journals get off that lightly. The researchers behind six of long standing journals chose to stop the journals; Danish researchers have lost journals established in 1866, 1914, 1955, 1967, 1969 and 1993.

This policy that was set for a few journals is planned to be expanded to all Danish and foreign journals with articles from Danish researchers. The government is working with plans to mandate all researchers to archive their manuscripts in public repositories. Those repositories will function as public-supported publishing in competition with the journals with paid subscribers. When the public sector offers manuscripts for free the competition with result in the same mechanism as mentioned earlier. The journals will miss income and many had to reduce their quality work and number of pages or had to stop publication.

Partly a planned destruction

The policy is dangerous because its consequences may be to destroy academic publishing. However, the policy is made by research libraries and has as one of its aims to weaken publishers.

The explanation is twofold. First, the university libraries are threatened by the technological developments when publishers deliver not only the journals but nearly everything in a digital format. Librarians no longer write on index cards, put journals on bookshelves, retrieve them from borrowers, keep track of loans, etc. Instead, they buy a large packet of subscriptions through a discounted deal. Therefore the policy is a way to maintain the existence of the libraries through building and running databases.

The other part of the explanation is that libraries have an increasing number of journal subscriptions. The numbers of journals are proportional to the numbers of researchers and because of an increase in the numbers of researchers in China, Brazil, India and other countries, more research is done and this research has to be published.

Publishers try to have this research financed by their traditional customers in the U.S., Europe and Japan, and the rice in prices for this—and new digital services—is too much for research libraries.

In reaction, many libraries now require a model of open access called "author self archiving." Through an international lobby, librarians have pushed for a requirement for researchers to archive their research in databases organized by librarians. With acceptance of this model, librarians could maintain a central role in the future.

At the same time the free manuscripts in databases should give a competition to the greedy publishers to have the subscription prices lowered. This is a well-known argument in the Open Access debate and mostly stated by the "inventor" of the "green" Open Access, Stevan Harnad.

Libraries are stronger than journals

It can be a surprise to see that the library sector is setting the policy on such an important area in the academic world, but there is an explanation based on organizational matters.

At the universities the research library is a total service that literally has a cable through all departments. The libraries are not competing against each other—at least not that much—while the departments compete against each other. All parts of the library system have to work together because the idea is to have one common infrastructure system. A unified sector is stronger than a fragmented larger one.

The journals, the other part, are not an organic part of the universities as previously discussed. All parts of the universities have the advantage of the journals but they do not have ownership of them. They are not responsible to journals with editors from competing universities on their editorial board.

State Intervention Necessary

An international development

The development in Denmark is happening all over the world. The competition among universities has increased in the last decennium. The internationalization has increased and students often are encouraged to study at several universities (often abroad) to get an international personal network. Therefore the universities compete for students and their money.

There is an international competition for the best researchers and teachers to be more competitive, and the international competition for money is increasing not only for EEC resources but money in cross-national funding of research projects.

On the organizational level, the development against a managerial dominated university happens in parallel helped by reports from OECD and international conferences with this message. The political system in the EEC is built much more on central planning than the original decentralized academic cooperation; therefore much of the policy from EEC is centralized in its scope.

The research libraries are working internationally in very strong organizations where many have a very articulated target to work with lobbies at an international level.

First, the American libraries got a very narrow cooperation through the *Association of Research Libraries* and in 1997 the organization established *SPARC* as an organization with a strong focus on lobbying and fighting publishers. This organization has a European branch, *SPARC Europe,* founded in 2001as one of many public funded lobby organizations. One of them is *Knowledge Exchange,* an organization between Danish, British and Dutch lobby organizations.

These lobby organizations have been very successful in lobbying against the EEC and other international organizations.

Intervention is necessary but dangerous

Unfortunately, all the approaches mentioned pose a severe threat to high quality journals. None of the players mentioned will voluntarily change their policy. The consequences will be visible at different times in different areas.

First the small journals in the humanities and social sciences will be hit by the policy. They are often small because they focus on regional cultures and local societal conditions contrary to the

STM (science, technology, and medicine) with their international approach. Often the journals are published in a native non-English language, too. At the same time the humanities and social sciences are the weakest sectors in universities because the managerial ideology often will favour practical business. The small secondary international journals will be hit by the policy second.

On the contrary, the big publishing houses will be strengthened by this development. When their competitors are weakened the large players will stand stronger. Only an intervention from the state can stop the worst consequences from occurring. Yet, this action will rob the journals of their academic freedom, possibly leading to a negative impact on their quality, and of course will be a thread to the academic world itself when the political system is so close to publishers. The political system can arrange its money to “kind” areas while more critical areas will be suppressed. In the editorial process the editors can make other decisions to please the paying hand rather than the academic truth.

About the author

Jørgen Burchardt is chairman of the Danish Science Editors and member of the board of the Danish Science Journalists Association. He is a researcher with many books about knowledge dissemination and business development. For more than 30 years he has worked as an editor of national and international academic journals. In 2001 he organized the first Danish peer-reviewed Open Access journal.

Carrier of Science Communicators in India: Present & Future

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Abstract. India is experiencing an extensive transmission of science communication activities. Government, Public institutions, Schools, Colleges, Non-government organization and a number of associations are actively spreading scientific knowledge not only via traditional media but also through specific forms of interaction with varied public. Knowledge about science & technology is inevitable in this modern hi-tech world. There is a massive demand & vast scope for science communicator or person who popularizing science among the public or society or masses. Nowadays science & technology department, print & electronic media, NGO's, Environment institutions, Forest department, science communication centres etc. have huge demand for science communicators. Government, Science & Technology department, education institutes are now setup the Scholarships, fellowships, training and courses to develop talented and skilled science communicators. In present time science communicators got key position in India and this shows that science communication field and science communicators will demandable in future. This paper aims to provide overview of the diffusion of science communication and science communicators in India illustrating its current development and future prospects.

Why communicate research to the public?

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Abstract. There is a global insurgence for communicating research to the public. But the very first question arises why communicate research to the public? Why public should know about research or S&T? Why scientists should spent their precious time in talking to or writing for the public rather than working on a new paper? Scientific research, scientists and the public show a very intricately woven relationship. Scientists cannot do alone their research without public support and the public cannot solve their problems without scientific interventions. Advances in scientific research and their implications on society are critically important in the modern information age. The results of research have a direct bearing on our socio-cultural and political life. S&T is confronting man at every step of life.

A greater demand for an increased access to the scientific knowledge by the different communities has been realised. People, whether literate or illiterate, are living in a world of science and technology and survival in this S&T age can be very difficult if they are devoid of scientific knowledge. Access to scientific information is the key to survival in this hi-tech world. Science communication protagonists are demanding scientists, in addition to communicating their scientific research to the peers, to communicate their research in a popular language to the lay populace – the ultimate consumers of research. In fact, communicating research or S&T advances to the public is the need of the hour and so scientists should play an active role here. Further, science communication can ensure transparency in the pursuits if scientific research and can help in developing consensus on controversial issues and can provide the direction in which science should march ahead. It can also do a lot in democratizing science.

A critical review of the problem ‘why communicate research to the public?’ is proposed to be presented in this paper highlighting and discussing the various factors which can only be addressed through science communication. Role of science communication in democratizing science is also proposed to be discussed in the present paper.

Keywords: Science communication, Need for research communication, Benefits of science communication, Transparency, Democratizing science

The use of Information Communication Technologies (ICTs) as a tool to advance science across cultures in multiple societies

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Abstract. The ICT component of Science Communication was brought into SAASTA with the aim of furthering the advancement of Science, Engineering and Technology (SET), and is aimed at investigating new, interactive ways of spreading awareness on SET that is not only tailor-made for a specific set of disciplines or sets of information, but to also communicate across cultures – breaching the demographic gaps, while considering sensitivities of all cultures. SAASTA runs programmes across many disciplines, including Public Understanding of Biotechnology (PUB), Public Nanotechnology Engagement Programme (PNEP) and HySA Public Awareness Platform (HySA PAP) and more, and the use of ICTs can further advance these programmes and aid them in reaching their objectives.

South Africa is a country with extremely diverse groups of people, cultures, languages and behaviours. Reaching and identified target audience with a very specific message has become an art in the present day, as mass-media messages falling on deaf ears are now a thing of the past. With certain types of ICTs, tailored to its intended audience, with the correct communication message attached, can be far more effective and cost-effective than mass paid media or “media buying”. This paper will investigate social media as a form of communicating science, as well as which new media are the most effective, what works and what does not and so on. It will also look at exhibitory, and how the game has been revolutionised. Static ‘poster’ exhibits only work in certain areas, but an interactive touch kiosk exhibit can work wonders for growing a young child’s enthusiasm in a particular field. ICTs allow the message sender to target an audience incredibly accurately and if the message conveyed is correct, ICT communication channels can and will be far more affordable and effective, as there is no longer the effect of casting a wide net hoping to catch only the intended few.

Naturally, advancing science does not end at South African border posts; South African science advancement also plays the global game. With so many cultural differences between the various nationalities, bridging cultural gaps are challenging for any communicator, let alone science communicators. This paper will showcase a truly remarkable project undertaken earlier in 2010 where SAASTA had to bridge the language and cultural gaps between South African science communicators and the Chinese public. An exhibit showcasing South Africa’s National Science Institutions was created and sent to Shanghai for the World Expo. Elements to be discussed will include, the background of the project, the necessity for it, the various and multiple challenges faced in its development – which included technical as well as translation and cultural challenges – and its performance in Shanghai. Another aspect to be discussed will be how to retrieve viewership data from this exhibit, and future ways to adapt it and use it within South African borders and in other countries across the world.

The various elements of this paper and presentation will cover: the correct use of websites in communicating science; technologies available and the application of these technologies; social media as a form of communicating science; growing social interest in science communication; international and national best practices; how it is done in other parts of the world; a look at the future; a comparison with the past; “hit” statistics with social media; exhibitory and how far it has come; and, what can be learned from using the incorrect ICTs for certain messages.

Metaphor as a Medium of Electronic Communication

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Metaphor, of course, is an essential component of poetic language. The central role of metaphors in science seems to ensure that science is open-ended, suggesting that conceptions of reality will always be open to change and interpretation. This study aims to examine some of the uses of metaphor in science communication and to provide a conceptual understanding on this topic. As we shall see, metaphor enters into the communication of scientific ideas and at times influences the formulation of scientific problems and the ways in which problems are conceptualized and approached. This paper specially deals with metaphor in electronic communication. The use of metaphors helps us understand new concepts, and the way that we talk about electronic communications is highly metaphorical.

For instance, the idea of cyberspace as a place is reinforced by the media as well as by the people who use electronic communication. And the people who communicate online frequently discuss aspects of cyberspace; what it is, where it is, when it is, and who its citizens are. Cyberspace has become then, a commonly used term for representing this system of electronic interactions. Thus we use the words, “cyberspace”, “information highway” and “the Net” for electronic communications.

Science, Politics and the Media: The Climategate Disputes in France

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Abstract. Science is increasingly part of the public domain: scientific controversies, previously well protected from the public eye by the tacit rules which organize scientific communities since the XVIIth century, are more and more open to public inquisitiveness. There is a growing interdependence between science and politics. Political decisions must rely on scientific expertise while scientific and technological options and choices are evermore subject to political bargaining. The debate on climate change and global warming is a good example of this new direction in science history (history of science).

This paper will deal with the most recent media events concerning the "climategate" in France. We shall start with the analysis of Claude Allègre's *L'imposture climatique ou la fausse écologie*, which was published in February 2010 and triggered a number of responses of all kinds in the media. C. Allègre is a well known geophysicist and former minister of education and research in the last socialist government. His climatoskeptical views were already well known and widely discussed in the media but his book appeared as the last straw. The French community of some 400 scientists, as different from each other as the disciplines and the specialities they represent, but all involved in the French branch (GIEC) of the IPCC, published a petition against the «lies» of Claude Allègre, asking their minister, Valérie Pécresse, as their employer, to reassert the scientific status and the seriousness of their work and to prevent further public diffusion of additional «lies» by Claude Allègre and his colleague, Vincent Courtillot. Allègre's crime according to the signatories of the petition is to have published under the cover of scientific background without peer control. This petition, in turn, was followed by numerous reactions in the media, generally condemning this appeal for a political intervention in what was considered by most journalists and popularizes as a scientific debate between experts. The petition also showed the difficulty for these scientists, highly specialized in various fields, to accept their position as lay people in relation to each other's narrow competence over this or that aspect. The general issue of climate change and global warming with its political overtones leaves them helpless within the public debate. Hence, this curious demand of the community to reaffirm the necessity of a clear cut separation between science and politics in order to recover an autonomy which would be provided by a politician! Such a move is contradictory as many debaters like Jean-Marc Lévy-Leblond or Benoît Rittaud have pointed out in the media. Bruno Latour's position presented in *Le Monde* (22nd of May, 2010) is also ambiguous. Recognizing the impossibility to disentangle expert's science from politics, Latour advocates for a new distinction between science and research. While the former is an area of undisputable facts prone to be popularized in a traditional way (reinforcing autonomy and control of the scientific communities on the public divulgation of «their» knowledge!), the latter integrates uncertainties within the field of scientific experimentation as well as within the field of political action. According to Latour, the «good» link between science and politics should involve a confrontation with uncertainties in both areas under the arbitration of the cautionary principle. How could the media deal with such a «proposal» which would radically change its role in the management of the relationship between science and society? It is within such a media turmoil that the journalist Sylvestre Huet from the newspaper *Libération*, published his response to Claude Allègre (*L'imposteur, c'est lui*, Paris Stock, April 2010) pointing out all the scientific mistakes and inaccuracies in the book in order to discredit the political argument of the geophysicist. The journalist is attacking Claude Allègre as a scientist with scientific arguments while the latter is dismissing these arguments by relying on the global political relevance of his argument against the anthropic origin of global warming. Within this paper, we seek to identify the scientific and political stakes of this strange controversy.

Different Perspectives on How Nations View Technical, Methodological, Legal, and Environmental Issues on the Inclusion of CCS in as CDM Project Activities

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Abstract. It is discussed at the international level regarding the eligibility of CCS (Carbon dioxide Capture and Storage) under the CDM (Clean Development Mechanism), owing to unresolved concerns. Among them, (a) non-permanence, including long-term permanence, (b) MRV (Measuring, Reporting and Verification), (c) environmental Impacts, (d) project activity boundaries, (e) the potential for perverse outcomes, (f) safety, and (h) liabilities are the areas open to dispute.

As for non-permanence, including long-term permanence, some parties have raised concerns over the risk of seepage from CCS projects over the crediting period and the risk of sudden, massive release of CO2 and the implications. Other parties, mainly developed nations, argue that the risk of non-permanence or seepage is a manageable risk.

As for measuring, reporting and verification (MRV), some parties argue that monitoring would add unmanageable complexity to the CDM and that the CDM institutional structures would need to be modified to accommodate CCS. Some parties argue that the technology and processes to provide accurate MRV for CCS already exists. As for environmental impacts, some parties argue that the lack of experience with CCS compared to current eligible CDM projects and the uncertainty surrounding risk of seepage make Environmental Impact Assessments (EIAs) challenging. Other parties argue that CCS project management measures and practices are developed to identify, address, and prevent the risk of seepage from CCS projects.

As for project activity boundaries, some parties argue that there are difficulties in defining the project boundaries if there are several different injection points from different project activities in different time frames. Other parties argue that project boundaries for the storage reservoir would be defined by the site characterization, including any potential seepage pathway, modeled CO2 migration path, and any potential secondary containment formations.As for the potential for perverse outcome, some parties raised over perverse outcomes of inclusion of CCS in the CDM relating to : i. CDM market implications; ii. increase of fossil energy production; and iii. subsidization of Enhanced Oil Recovery projects (EOR). Other parties tell that inclusion of CCS is not expected to significantly impact on CER markets in the short to medium term, with uptake in developing countries being gradual over time.

As for safety, some parties have raised safety concerns related to the inclusion of CCS in the CDM, notably in relation to the risk of catastrophic release of sequestered and stored CO2. Other parties argue that best estimates of seepage rates by geologists are well below levels that would cause any significant increase in atmospheric CO2 or risk to public safety.As for liability, some parties have raised concerns relating to the assignment of liability to account for emissions associated with seepage (or liability for non-permanence). Other parties consider that the modalities and procedures should require that proposed projects are in compliance with all relevant national laws and regulations for the deployment of CCS.

In this research paper, theoretical background on how different nations analyze the scientific fact - technical, methodological, legal, and environmental issues on the inclusion of CCS in as CDM project activities, based on different backgrounds.

Communicating Science–Making Europe: A Critical Analysis of Two Decades of European Commission's Science-Society Policy

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Abstract. From the mid-1980ies onwards many European member states started–although with very different intensity and developing diverse approaches–to put in place programmes and activities addressing science and society issues. Ranging from new forms and formats of science communication, over more interactive and dialogue oriented settings to public participation exercises, in each national context specific, culturally grounded sets of initiatives were developed. In this patchwork of diverse national science and society initiatives, the European Union entered the scene by the late 1990s as an important player. Since then the European Commission has been carrying out substantive survey research on science and society in Europe, has launched and supported numerous programmes funding research and actions in the domain of science and society, has issued numerous reports and policy statements, created science communication awards and many more. Through these activities the European Commission was aiming at supporting the formation and stabilization of Europe as a research area, as well as at creating favorable conditions for making Europe a competitive knowledge economy.

This paper aims at analyzing these European policies concerning science/society interactions over the nearly two decades. It will explore questions such as: How were these interactions between science and society imagined? Which forms and formats did they take? How were they discursively framed? What were the different expectations of the actors involved? And how did all this tie into different models of a future European knowledge society in a global context? Main issues discussed will also cover the changing visions of who would be these "European publics" to be addressed, of why people should understand technoscience, of who is supposed to communicate and actually what should be understood about science. Yet more importantly the question of how these framings of the "science and society problem" changed during the last decades, e.g. from understanding to awareness to engagement, how that impacts on the ways technoscience is integrated into contemporary societies and what future challenges are waiting in this domain will be critically addressed. The empirical basis of this paper will an extensive study of policy documents, programmes and action lines, evaluation reports and many more.

Problems in Using CITs for Science Communication in Less Developed Countries: A Study of South Asian Science Communication Discussion Forums

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Abstract. Phenomenal growth of the mobile telephony in the less developed world, particularly in India, much as the same way as that of the Internet in late 1980s and early 1990s, has changed information and communication technologies (ICTs) in the 21st century to communication and information technologies (CITs). But the relationship of information and communication is getting even more symbiotic.

Even when ICTs are reaching remote corners in less developed countries, their potential as a powerful tool for science communication activities largely remains untapped. The depth of ICTs for science communication activities in India is very limited, thanks to systematic decline and neglect of a few other components of national information suprastructure and infrastructure. One example of this can be secondary and tertiary education policies and infrastructure that has increased info- and digital divide within the country leading to a communication divide. The divide between elite and non-elite institutions in communication and information potential is also increasing. But looking at a rosy side of the picture, ICT tools and applications have the potential to bridge many of these gaps. Discussion forum is an example of one such tool that can be used without great sophistication or infrastructure at users' level. But, discussion forums as tools for science communication are few in south Asian region in general, and India in particular, and many of those that have been launched are not working anywhere near their optimum potential.

A study of a few science communication discussion forums in south Asian region is being carried out and preliminary results show that most of the resources are used simply for sharing of information, while discussion on science communication–the primary purpose of any such forum–remains neglected. Problems associated with discussion forums are also discussed, along with methods and ways by which their efficiency and effectiveness for science communication is increased.

Scientific Citizens: Understanding Science Movements and Democratization in India

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Abstract. The proposed paper is based on several case studies of science movement organizations (SMOs) in India. These case studies include some of the more active SMOs–*Kerala Sashtra Sahitya Parishad* (KSSP), *Marathi Vidnyan Parishad* (MVP), Delhi Science Forum (DSF), *Eklavya*, and *Bharat Gyan Vigyan Parishad* (BGVS)–all integrated under an umbrella network known as the All India People's Science Network (AIPSN). Based on primary as well as secondary data collected from SMOs, this paper attempts to (a) portray the life cycles such as emergence (ideological roots), growth (activities and diversification, if any) and decline/renewal of these SMOs, and (b) analyze the said phenomenon from the vantage of social movement perspective. Science movements in India might have started as a discursive movement where activism started with a discourse and later on manifested in some form of social mobilization. But as the analysis of this study shows discursive formation is not an encompassing framework to justly explain the movement. It fails to do so particularly because of the grassroots activities of KSSP and emergence of pan-India organizations like BGVS that indulges in popular social mobilizations. The analysis indicates that of late, the science movements in India have taken the shape of social mobilization. At the same time it further indicates that science movements have grown beyond the conventional social movement framework, i.e. from mobilization to institutionalization. The emergent institutions have not culminated as the end-processes, rather make an intermediary phase, beyond which some of these SMOs have become dormant, some have started declining, some have withered away making way for new institutions and some have emerged stronger by realigning themselves under larger umbrella organizations. In the process the movement renews itself, as new SMOs have also emerged. But at the same time it is observed that the movement has lost its original radical teeth, spontaneity and focus. More of it have come under the influence of the government and have shifted their areas of focus (to literacy, environmental awareness and even rehabilitation and resettlement issues). Hence, science movements in India now have acquired more the hues of "social–activism" (not that of pure science as it was earlier). The paper is one of the pioneering works on public communication of science and technology in contemporary India, through which attempt has been made to identify science with social criticism/activism and to perceive the same through social movement perspective. By studying science as a means of social criticism and social activism the paper forges a strong link between science as a social institution and contemporary social processes in India.

Birds Eye View of Science Communication

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Abstract. History of science is the story of mans progress in understanding the world around him in gaining control over the forces of nature. Right from the ancient scientists in dawn of recorded history, we try to bring the history of science from pre historic age to today's race for space, information technology and nano-science.

Keywords: History, Science, Development, Discovery, Communicate

Introduction

One of the most important contribution in mans progress has been perfecting the communication system by which a constant inter change of knowledge is brought about. The early men were able to communicate with one another only through the use of signs. Then came the development of language and writing, by means of which men could express an infinite variety of concepts and also transfer them from one generation to the next. The centuries that followed, saw the rise of other forms of communication ,printing, type writing, photography, telegraph, telephone, sound recording devices, radio, television, radar, facsimile transmission, micro filming , internet, mobile communication and so on.

Science is not always contained merely to learn about the world, and its application to industry (technology) it is greatly concerned with modifying it as far as possible. We shall never know when this never ending task began. The word science which we use today is a comparatively new word in the English language. Man's greatest scientific discovery, the use of fire dates back to pre-historic time. Importance of writing in the development of every other branch of knowledge can never be ruled out.

Science communication is a discipline that has very rapidly developed in theory and practice since 1995. A good communication between science and society leads to the development of scientific culture which can be utilized to solve global, regional, physical and social problems. Good science communication can help in the economic, cultural and social progress and overall well being of the global society.

Bird's Eye View of Science Communication

Ancient science

We can date back man's greatest scientific discovery, the use of fire and use of language to communicate to pre historic period. In this period man learnt to make some tools, which enabled him to survive and win mastery over other creatures. From the dawn of history, sun-the source of heat and light for earth has been worshipped as God. The movement of heavenly bodies like sun and moon may be recorded as the earlier scientific observations. The early observers impressed by the regularity with which they swept the sky and earlier calendars were based on the movement of moon. 4236 BC may be recorded as the earliest fixed date when first lunar calendar was developed. Later on for more accurate calendar were developed based on rising star called Dog Star. We can say that science of observation started with priests who can be called Priest-Scientists. These priests' scientists were anonymous. Both, Egyptian and Babylonian developed number system.

As the time progressed, the Egyptian architect-Physician 'Imhotep" designed the step pyramid in 2980 BC. His contemporaries had knowledge about medicine and surgery, the EDWIN SMITH SURGICAL PAPYRUS is the oldest scientific document written on papyrus and rolled up in the form of a scroll. 450 BC Hippocrates is known as father of medicine. Among primitive people medicine, magic and religion all went together. Babylonian had knowledge of Botany as well because they were familiar with date palm. Ancient Hebrew was more eager to know the relation between man and god rather than man and surroundings.

Early Greek thinkers were keen to find what the world is made of? To early Greek thinkers what we call today science was only a part of philosophy. It is only embracing search for wisdom. It was a religious cult philosophical school and a political movement. Pythagorean brotherhood was one of the most important groups that influenced the development of science in Greece. Pythagoras was founder of this group. He travelled widely. He set up a philosophical school whose members were bound by a vow to follow religious rites prescribed by which it remained powerful till 450BC. Pythagoras Theorem still appears in the geometry textbooks all over the world. Plato has been impressed by the Pythagorean belief in the importance of mathematics as the key for understanding the universe.

In fourth century BC, Greek philosophy reached its peak with Plato, Aristotle and their followers. Their ideas and metaphysics and ethics influenced the development of science. Socrates, 399BC was the creator of scientific method: inquiry, dielectric and conclusions. Plato, 347BC was one of the accomplished mathematician and a philosopher. He introduced logic into study of mathematics and made the way for Euclid in the next century. Aristotle was the student of Plato, he introduced the concept of diagrams, reviewed and criticised the previous knowledge and gave his own observations and opinions. Aristotle's work on biology in which he described life and breeding habits of 540 species of animals is very close to modern scientific method.

Aristotle reigned as supreme in the scientific matter even up to two thousand years after his death. The errors of Aristotle in physics and in astro physics held up the scientific progress till seventeenth century. Newton demonstrated that forces operating between heavenly bodies and that which makes the apple fall on ground are same.

Middle age science

From seventh century Islam religion founded by Prophet Mohammad played a great role in transmitting knowledge. Followers of Prophet spread their master's knowledge, by ninth century Arabs become the standard bears of scientific knowledge. It lasted from 900-1100 AD. The number system which we use today, Hindu-Arabic system derived from Al-Kwarizmi (ninth century) from Hindu mathematician of India. It originated with the Hindus and was carried to the western world by the Arabs. It fits into the most of our commercial and technical needs very well. Hindus also introduced the concept of negative numbers. Persian born physician Rhazes classified substances as animals, vegetables and minerals, a classification which still prevails in day to day dialogue. He was the first person to distinguish between small pox and measles.

One of the great Arab physicists Alhazen, his main contribution was the treasury of Optics, he worked out laws of reflection, atmospheric refraction, theory of vision. Eminent physician Avicenna was the author of Canon of Medicine, its translation became the famous text book for Western Europe for several centuries.

By the end of twelfth century, translations in Latin were available to European scholars. Greek work was translated into Arabic and Arabic into Latin. In the middle age advancements in pure sciences were comparatively insignificant but application of science to industry started developing. Glass making, iron foundries, paper making, printing press, marines/compasses, gun powder to be used in warfare. There was some of the outstanding industrial development. The first complete book printed from movable type of printing press was an edition of bible known as Gutenberg Bible 1455 AD. The importance of printing press in Science communication is to involve masses in scientific culture, to create an awareness of technological revolution which 20th century had witnessed and an attempt to achieve 'need to know" type of awareness.

In the Middle Age Science was linked to traditions. The ninth and tenth century it was predicted that the year 1000AD would mark the end of the world, but the calamity did not arrive. By the end of twelfth century the language barrier has been crossed, and Greek and Arabian scientific work has been translated to Latin. West came in contact with east, their literature, philosophy, science, architecture, art and industry. The growing thirst for learning resulted in setting up of universities and cathedral schools which were influenced by religion. The incorrect scientific views were hardly challenged. Aristotle, Ptolemy and physicians were supreme authorities. This view point was entirely hostile to spirit of free investigation.

In the thirteenth century, Robert Brown (1214-94) challenged the restriction for free investigation. He developed the science of experimentation. He was the first to suggest the use of lens for spectacles. But he is today remembered more popularly for the invention of gun powder. He was ahead of his age, he predicted horseless carriages, ships with sail, flying machines, and machines to lift weights, and fortunately we are using all these things today.

Progress in science comes from communication and criticism of ideas and theories. In the seventeenth century for scientists and philosopher's income and support came from other sources, they had to struggle hard to communicate with each other .This lead to development of scientific societies. Probably the earliest scientific society Secretornm Naturae, founded in Naples in1560 but it was abandoned for the fear of magic and black art. Another

Italian academy was founded in Rome in 1603 Accademia dei Lincci. This was more respectable and its modern version still exists today. These invisible colleges were more in number in England during seventeenth century. Robert Boyle was a regular user of it at the one at oxford. These invisible colleges had no building, no faculty, no students, no resources and no regular funding. They were informal association of brilliant men anxious to share and compare thoughts, ideas and observations. The humble beginnings of invisible colleges led to the development of Britain's famous Royal Society in about 1645. This society flourishes today also. In March 1665, the society began the publication called The Philosophical Transaction of the Royal Society. This and the French JOURNAL DES SAVANTS are one of the few oldest journals published. With the founding of Royal society the science became fashionable, many rich noble men, dressed up well, attended the theatre to watch a 'show'. They observed the spectacular experiments in each weekly meeting. Royal Society focussed on experimental demonstrations [9]. The evolution of scientific societies had the most beneficial effect on the process of careful observation and experimentation, acute criticism of contemporary scientists had to be faced. They learnt the advantages of selfless cooperation among each other to find out the scientific truth.

New age science

The period of 1660AD to 1700 AD may be called the classical period of microscopy. The achievements made were unsurpassed up to nineteenth century. In 1672 Newton reported to Royal Society his findings on which he was already working and an Era of Newton began. Newton's Principia was published in Latin. In 1669 he was also elected as one of the eight foreign members of French Academy of Science. In his later years of life, he had a quarrel with noted mathematician Leibnitz over calculus, but Leibnitz method of writing was better so it has been adopted. Newton system of universe remained uncontested for more than two hundred years.

One of the Newton good friend and learned disciple, astronomer and mathematician Edmund Halley is best remembered for the accurate prediction in 1704 of Halley planet which bears his name. Halley's' chief contribution was the "estimate of the degree of mortality of mankind" which laid the foundation of life insurance business, life tables were drawn. His wife was devoted to him but was complaining against him for dissipating family fortune in useless scientific experiments, expedition and publication. He also intended to publish Newton's Principia with his own expense.

The period of 1765 -1815 may be called as age of chemistry; Lavoiset has been called the Father of Chemistry. He published Elementary Treatise of Chemistry, and Methods of Chemical Nomenclature. He and Joseph Priestly were sympathetic towards French Revolution. Joseph Priestly's one of the discovers of oxygen published in History and Present State of electricity. Henry Cavendish performed great many electrical experiments but did not publish them; he thought them to be not as per his high standards. His laboratories notes were published by James clerk Maxwell in 1879. French military engineer Charles Augustine Coulomb made significant contribution in electricity.

Last of eighteenth century was the age of American and French revolution and Industrial revolution, that is substitution of machines for hands that led to mass production and factory setups. Scientific thinking was employed for solving industrial problems

The period of 1800-1900 saw a group of Britain scientists Faraday, Maxwell and Hertz and other making unifying generalization intimate connection between light, electricity and magnetism. Twentieth century enjoyed the fruits of discovery that light heat and radio waves are EM waves in the field of radio, TV, radar, mobiles etc. Concept of Ether was introduced and Maxwell's electromagnetic theory of light was based upon this hypothetical medium called Ether.

Law of conservation of energy is one of the great contributions of nineteenth century to the development of science. Up to nineteenth century a rigid distinction was made between matter and energy but the twentieth century scientist has demonstrated that matter and energy can be transferred into each other, and the era of atomic energy and atomic bomb began. Bombing of Hiroshima and Nagasaki in World War II has led to era sins and sorrows produced by science and technology. Achievements of the science dominated the twentieth century with the start of a debate whether science is our master or slave. The decade from 1895-1905 is often called a miracle decade. The scientific developments of this period were the culmination of centuries of thought. Brief mention of this discoveries and invention is given for physical sciences:

aeroplane, astro-physics, electronics, atomic physics, radio activity, relativity, x ray tube and vacuum tube. Biological science: biometrics, bacteria, microscope, virus.

The miracle decade witnessed the establishment of philanthropic foundations like Carnegie foundation, industrial research laboratories. Nobel prizes in medicine, chemistry, physics and physiology were established and were first awarded in 1901, this had a powerful effect on scientific achievements. Just before the miracle decade, scientific and industrial progress to have come to stand still.

In 1905 a clerk in Swiss patent office, Albert Einstein published a paper on '"Special theory of Relativity" and higher physics was born. The most remarkable team of husband and wife is of Pierre Curie (1859-1906) and Marie Curie (1867-1934) for the discovery of radium; they received Nobel Prize in 1903 along with Becquerel on radioactivity. Marie Curie received another Nobel Prize in1911 on her work on radium. She died in1934 of pernicious anaemia. She was the eventual victim of the radioactive bodies she and her husband had discovered. This proved how dangerous these radioactive substances are when they are not shielded.

Role of Science and Technology in World War I and II

Before World War I 1914-18, the education of military men always was to teach them how to fight the last war over again and not how to fight the next one. Their education material was a three volume treatise by Karl von Clausewitz on war which was based on Napoleonic times. But the advances in science and technology applied to ordnance, explosives communication and transportation caused the old ideas to be fearfully outdated. The use of submarines had upset the cherished tradition of war. All explosive contained nitrogen. The new process, known as Haber's process to provide nitrogen in usable form was discovered. Chemists played an important role n chemical warfare by using dreadful poison gas.

The World War II represented the triumph of applied science, technology, engineering and industrial know-how and an age of atomic weapons with atomic bombs began. It was a scientist war and more particularly a physicist's war. In World War II the victory fell not on the side of strongest battalions but on the side of best scientist and engineers. Atomic bomb cut the war short and saved millions of causalities but it did not win the war. Scientist worked ceaselessly to perfect offense and defence warfare, their efforts bore fruits in the form of super tanks, magnetic mines, jet and rocket bombs, radars sea crafts, submarines snorkels etc.

In the United States scientist were organised under a government agency OSRD Office of Scientific Research and Development it was a part of War Production Board. Other nations too organised their scientists for war, the British established Scientific Advisory Committee to the British War cabinet, and Canada established National Research Council, the efforts of scientists and engineers transformed into war machines and weapons. War production became the biggest business with special emphasis on crucial war material like steel, aluminium, rubber and petroleum . World War II took millions of lives but it also taught men how to save lives , DDT, insect killing chemicals, antibiotics and penicillin developed in the war proved to be effective against malaria and typhus fever. An expected outcome of World War II was population explosion throughout the world. The techniques of preventing medicine such as spraying on DDT and Inoculation against communicable diseases and anti malarial drugs were also the cause of population explosion. Now the big question of producing more food for more population arose. And science of agriculture was developed to solve World food problem.

Perils of Atomic Age

It is often said that atomic age began in 1945 when atomic explosions took place in Hiroshima and Nagasaki in August 1945. The public at large came to realise how harmful these radiations are. Before this only a small number of scientists and technicians were particularly concerned about radiation hazards. The deadly radiation emitted by the atomic bomb proved fatal immediately for thousands of people. As weeks passed by thousands of in habitants of Hiroshima and Nagasaki sickened and many of them died, they were victims of atomic bomb disease. After more than a decade of dropping of the bomb, people showed delayed symptoms of radiation damage penetrating radiation had become a problem that concerned not only few but the all mankind. The atomic bomb was the chief peril that confronted man in the atomic age. International commission on radiological protection has been set up to recommend safe exposure limits for professional people working with radiations. Roentgen is the unit. The people who received less than 100 roentgens of radiation were not sickened by exposure. This is a rough yardstick for estimating how many people will survive in future war after an atomic attack. The wisp of the bomb cloud that formed over Hiroshima after the explosion on 6th August 1945 floated around the world and were detected over the United States also.

After the atomic bomb explodes there are three types of fallout: local, troposphere and Stratospheric. Local fallout occurs within hours after the blast and comes to Earth within i distance of several hundred miles from the bomb site. Troposphere fallout has a wider distribution, it may take place over a period of several weeks, radioactive fragments travel thousands of miles. Stratospheric fallout occurs, the radioactive particles push into the stratosphere above the Earth surface and the fragments remain suspended for very long periods of time and fall to earth very gradually, this fallout is global in extent.

Uncertainty in Science

Science in nineteenth century appeared to be materialistic; scientists had cast of ties with philosophy. In the twentieth century the situation changed with Einstein's epoch making theory of relativity followed by the principle of uncertainty. Modern science does not speak with certainty. Its tone has become tentative, relative and uncertain. The field of higher physics was born. Physicists have to believe in impossible, invisible and uncertain. They had to perform hypothetical experiments and philosophical enquiry to solve the scientific problems. The serious problems of uncertainty in science were highlighted by German physicist Werner Heisenberg in the form of uncertainty principle. We have come to realise the true limitations of science and have led us to the question: what is the Absolute Truth?

Control of electrons, the invisible negatively charged particles led to the development of electronics which revolutionised our livings in every corner of the world. The journey started with the electronic tubes followed by transistors, LSI, VLSI etc. Invention of transistor earned the Nobel Prize in physics in 1956 for Bardeen, Brattain and their co-workers. During first half of the 20th century, electronic circuits used large, power hungry and unreliable vacuum tubes. In 1947 John Bardeen and Wharton Brattain built first junction point contact transistor. Frank Wanless described the first logic gates using mosfets in 1963. The Gaudin Moore observed in 1965 that plotting of the number of transistors that can be most easily fabricated on a chip. The incredible growth of electronics has come from miniaturisation of transistors and improvement in the manufacturing processes. As transistors become smaller, they become faster, dissipate less power and are cheaper to manufacture. This synergy has revolutionised not only electronics but also society at large. The twenty-first century is going to be the decade of nano technology.

Purpose of this paper is to highlight for the twenty first century living beings that they should not forget how differently people live before they learnt how to harness the power and set the forces of nature to work. Quest for knowledge and history of science shall continue to remain fundamental human right for any individual born on this planet. There should not be any racial, regional, social, cultural, language barriers. Moral and ethical values should centre on humanity. Burning issues like global warming, it is not bound by any regional, cultural or social barrier. It is bond to affect whites and blacks, rich and poor. This is not a regional or national issue, but this has been a universal issue. If all the countries of the world continue to release green house gases this will lead to permanent changes and the whole planet would be affected.

Action plan 2010 science for all

1. Promoting scientific temperament in the poorest of the poor in the developing nations.
2. Promoting and nurturing women in science popularization.
3. Science for sustainable development and formulate planes to tackle some of the large problems which the world is facing today.
4. Contributions made by science to the world economy in the areas of electronics, nano-materials, computer and IT and health are ongoing and need to be appreciated. Many contributions have benefited people in developed nation more than those in the developing nations.
5. Science popularising should focus on energy and environment, health and economic development.
6. Develop and formulate an action plan for future, initiate new mechanisms of cooperation to carry out the action plan.
7. Knowledge should be free and accessible to all without copyright.

8. Storytelling and puppet shows to impart scientific knowledge to the illiterate.
9. Screen interactive CDs on environment space universe ecology etc.
10. Organise science and book exhibitions.
11. Use over head projector and slide shows to promote kitchen gardening, horticulture, fish production, organic farming bee keeping, solar cooking, water shed models to rural poor.
12. Create awareness amongst rural poor students about eradication HIV /AIDS , smoking
13. Retired scientists, teachers, professors and executives from MNCs may be invited to share their thoughts, feeling and their life journey, success and failure stories among generations.
14. Media persons to be encouraged and provided some subsidy to produce films on renowned scientists like Aristotle, Pythagoras, Einstein, and Newton etc.
15. Street play and songs, public movies, may be used to create awareness on public hygiene, sanitation, rain water harvesting, disaster management.
16. Awareness camps for removal of superstitious beliefs.
17. Industry –institute interaction as a part of science education curriculum.
18. Scientific knowledge should reach the poorest of the poor in the remotest corner of the world.
19. Principle of non-violence, peace, simplicity and universal cooperation is to be transferred to future generations along with scientific knowledge right from childhood.
20. Efficient management of time and resources available to every individual born on this earth is to be taught.

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New Wine must be put into New Wineskins: The New Key Word "Science Communication" has changed PUST Policy in Japan

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In Japan, there has been a long tradition of activities for Public Understanding of Science and Technology (PUST). While it is difficult to specify the starting point of such activities, we can recognize that one of the most important years was 1960 when the natonal science week was established. This may well have been the first such national science and technology week in the world. PUST activities mean what convey the pleasures of science to children. But you know those are top down activities. Such a long tradition of PUST in Japan has changed since 2005. The big change was triggered by a new key word "Science Communication." Although the concept of Science Communication has introduced into Japan since around 2000, it has had little influence till 2005. In 2005, the word "Science Communication" first appeared in the White Paper on Science and Technology 2004. It was an epoch-making event. Since then almost everything has changed. I recognized that one of most important things is a new name or word because people like novel movements and activities. I discuss about the transition from PUST to science communication in Japan. And I also show you our action plan for propagating science communication concept in Japan.

Science Communication through Community Science Centers

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Abstract. Hands-on Science is a unique approach of learning and teaching science to the children and students. The due importance of practical working has been given in teaching learning process. Involvement of children in actual working practicals, making working or non working models charts or involve into making chemical changes has been given more importance for generating curiosity. The model presented here is one such effort for involving children and public into activity based science learning and removal of superstition. Unique scheme of setting of community science centre in public private partnership has been evolved out and put in practice. Presently Eighteen science centers have been established; communicators are trained and continuously supported for carrying outreach activities through experiments at grass root level. Nearly nine thousand activities have been carried out at various places in last three years. The details are given in the full length paper.

Preamble

Science and Technology have played an important role as a tool of Socio-economic revolution hence development of science and technological capacity and its application have become an important and inherent part in the planning process.

Application of Science and Technology as a modern tool for Socio-economic revolution is very much required in the interest of all round and speedy development of the state. The state has undertaken various efforts through five year plan for equal. Multilateral and speedy development by using latest technology in the fields of Agriculture and its dependent industry, Engineering industry, Transportation & Communicators, Irrigation-Construction, Environment & Rural Development, Public health, Medical science & Education, etc.

Development of Scientific temper and scientific attitude in daily life among the people are very much important for Socio-economic development of the citizen of the Gujarat state. It is also important and very much required to create awareness among the people about removal of prevailing superstitions from the society through scientific approach so that Socio-economic development can take place.

Necessity of planned campaign in different regions of the state is felt for maintaining and increasing the continuous efforts as one of the option for creating awareness among the people. With an objective to accomplish this work, the state government feels it essential to set up and maintain the structure of community science centres covering the whole state. In context of the said requirement, establishment of community science centres of various levels in the state is considered through public private partnership.

Functions and Duties

Functions and duties of regional / district level community science centre shall be as following:

Regional level

1. Execution of all the activities as mentioned in the functions of district level community science centre at headquarter and nearby area.
2. Development of activity modules of new science and its awareness programmes and providing the same at district level centres.
3. Organizing training / seminar / lectures at various stages to train the communicators of district level.
4. Keep updated with scientific activities of other state and transferring the same to district centres.
5. Getting quarterly information of the activities of the district centres and providing necessary guidance. Making efforts to boost-up their activities.
6. Separate planning of activities for district centres for each quarter. Execution and coordination for continuation of the activities in district centres as per said planning.
7. Coordination of district level activities in the districts where science centre does not exist. To provide motivation and encouragement to the interested organizations of the district.

8. Publication of books and magazines which develops scientific temper.

District level

1. To organize scientific activities considering students of different age group, women and common people at community science centre and rural places of different talukas.
2. To establish science clubs involving schools and different agencies.
3. To organize popular lectures / science dramas / street plays or other programmes regarding superstitions removal.
4. To provide scientific guidance about the natural occurrences like earthquake, eclipse, cyclone, astronomy, etc.
5. Programmes like Quiz, Elocution competition, Science Exhibition, science lectures, science related different competitions, celebration of the events related to inventions and inventors etc. shall have to be executed through science clubs.
6. To organize awareness programmes for healthcare, food and nutrition, diseases and resistance power etc.
7. To organize programmes regarding soil conservation, water harvesting and management, environment, etc.
8. Entrepreneurship development and training according to local needs.
9. To organize awareness programmes regarding agriculture and organic farming.
10. Special awareness programmes for the rural and tribal community may be organized.
11. To spread awareness through video van programme.
12. Other scientific programmes, lectures, demonstrations may be organized.
13. All the Planning may be done in contact and in collaboration with respective regional community science centre.
14. Programmes conducted through application of EDUSAT may be done in contact with GUJCOST.
15. To demonstrate video films about scientific activities.

Financial assistance provided by GUJCOST

District level community science centre

Table 1. Financial Assistance to DCSC

	Capital Grant (Rs.)	Recurring Grant (Rs.)	Total Rs.
First Three Years	1,25,000 (25%)	3,75,000 (75%)	5,00,000
Forth Year and afterwards	75,000 (15%)	4,25,000 (85%)	5,00,000

Regional level community science centre

Table 2. Financial Assistance to RCSC

	Capital Grant (Rs.)	Recurring Grant (Rs.)	Total Rs.
First Three Years	1,87,500 (25%)	5,62,500 (75%)	7,50,000
Forth Year and afterwards	1,12,500 (15%)	6,37,500 (85%)	7,50,000

Advisory committee

1. Advisor, GUJCOST / Representative
2. District Education Officer / Representative
3. Principal, District Institute for Education and Training (DIET)
4. University Dean of Science Faculty / Principal of the engineering / polytechnic college nearby.
5. Director of the district institute involved in the activities of rural development / Representative.
6. Superintendent of the Civil Hospital / Reputed Doctor.
7. Manager of the District Industry Centre / Representative.
8. District Planning Officer / Representative.

Building and Equipments

Building

Following shall be minimum requirements of building for community science centre at district or regional level.

Regional level. It is essential to have an independent building which can accommodate the following. Laboratory room-4 (Physics, Chemistry, Biology, Maths), Laboratory equipped with audio-visual equipments -1, Workshop-1, Museum room-1, Lecture room-2, Library room-1, Office room-1 etc.

District level. It is essential to have an independent building which can accommodate the following. Laboratory -2, Lecture room-1, Mini Library -1, Museum room-1, Office room-1, and if possible then workshop-1 etc.

Equipments

Regional level.

1. All equipments for experiment up to the higher secondary level.
2. Computer with internet facility.
3. Multimedia Projector-1, Over Head Projector-1, Slide Projector-1.
4. T.V, V.C.R., Screen, Radio, Tape, Sound System.
5. Essential equipments for workshop.
6. Museum with 40 to50 working models.
7. Library having the reading facility with 40 to 50 magazines and 3 to 4 thousands books.
8. Essential furniture for laboratory.

District level.

1. Equipments for experiment up to secondary level.
2. Multimedia Projector-1,
3. Over Head Projector-1, Slide Projector-1 and screen.
4. T.V and V.C.R., Sound System.
5. Museum with 25 to 30 working models.
6. Library having the reading facility with 20 to 25 magazines and about 1000 science related books.
7. Mini workshop or Essential equipments.

Operational Structure of Community Science Centres

Regional level science centers

Table 3

No.	Designation	Qualification
1.	Chairman (Honorary)	--
2.	Science Communicators (3)	M.Sc. or B.Sc. with 2 years experience
3.	Assistant (1)	Std-12th pass
4.	Hamal (1)	--

District level science centers

Table 4

No.	Designation	Qualification
1.	Chairman (Honorary)	--
2.	Science Communicators (2)	M.Sc. or B.Sc. with 2 years experience
3.	Assistant (1)	Std-12th pass
4.	Hamal (1)	--

Purchase Committee

1. Advisor, GUJCOST / Representative
2. Chairman of the Community Science Centre / Vice Chairman / Coordinator.
3. Trustee of the trust governing community Science Centre.
4. Principal / Representative of the Science / Engineering / Polytechnic College / Secondary School nearby.
5. Principal / Representative of the District Institute for Education and Training (DIET).

Subjects of the Programmes

Popular lecture series / workshop / seminar

1. Astronomy
2. Agriculture, Horticulture, Organic Farming
3. Food and Nutrition and Preservation
4. Mathematics
5. Rural Technology
6. Public health, healthcare
7. Disaster Management
8. Environment
9. Biology and Biotechnology
10. Physics
11. Medical Science
12. Nano Science and Technology
13. Chemistry
14. Water Resource Management
15. Oceanography
16. Soil conservation and Management
17. Space Technology and Application
18. Earth Science
19. Electronics
20. Information Technology
21. Energy
22. Mathematics Model Workshop
23. Fun with Mathematics/Physics/Chemistry
24. Mathematic show
25. Self maid equipment workshop
26. Production of Scientific Toys
27. Electronics workshop
28. House hold electronic equipment Workshop
29. Water harvesting, roof water harvesting , farm pond and check dam
30. Introduction of herbal plants and preservation awareness
31. Science school
32. Origami workshop

33. Industrial work exposure
34. Research Paper reading Competition
35. Scientific career seminar
36. Formation of study groups
37. Posters/Painting/Easy Competition
38. Science Drama Competition
39. Air and water pollution.
40. Book/CD/Magazine Demonstration
41. Nature camp
42. Science Quiz/Science Seminar/Science Project Competitions
43. Awareness programmes for superstitions removal
44. Other Scientific Programmes

Community programmes & communicators training

1. House hold electric equipment workshop
2. Water harvesting, roof water harvesting, farm pond and check dam
3. soil testing workshop
4. Water Testing Workshop
5. Awareness programme for superstitions removal
6. Food adulteration testing workshop
7. Awareness programmes about AIDS
8. Awareness programmes about energy consumption/un conventional energy sources
9. Health camp and Awareness programmes
10. Entrepreneurship Development
11. Programmes of organic farming
12. Introduction of herbal plants and presentation awareness
13. Other community based Scientific programmes

Celebration of scientific days

1. World Wetland Day (2nd February)
2. National Science Day (28th February)
3. World Forestry Day (21st March)
4. World water Day (22nd March)
5. World Meteorological Day (23rd March)
6. World health Day (7th April)
7. Astronomy Day (21st April)
8. Earth day (22ndApril)
9. International Thalassemia Day (8th May)
10. National Technology Day (11th May)
11. World Telecom Day (7th May)
12. International Biodiversity Day(22nd May)
13. Environment Day (5th June)
14. World Population Day (11th July)
15. Ozone Day (16th September)
16. World habitat Day (1st October)
17. Wild Life Week(1st-7th October)
18. World Space Week (4th-7th October)
19. National Disaster Reduction Day (10th October)
20. World food Day (16th October)
21. World Science Day for Peace and Development (10th November)
22. World AIDS Day (1st December)
23. National Energy Conservation Day (14th December)
24. Birth Anniversaries of Scientists

Video van programmes, awareness programmes of superstitions removal

1. Video van Programme / Exhibition and Demonstration of Posters and scientific experiment film CD.
2. To create awareness about superstitious.

Science club related activities

1. Establishment of science clubs in school and to form a network of science clubs.
2. To provide literature of math's and science and other equipments to science club.
3. To organize workshop to guide students / teachers.
4. To organize competition of scientific programmes for the students / teachers members of the science club.

Minimum yearly programmes to be conducted by Community Science Centre

Table 5

Sr. No.	Type of Programme	District Community Science Centre	Regional Community Science Centre
1	Popular Lecture Series/workshop /Seminar	9	12
2	Community based Programme	6	9
3	Celebration of Scientific Days	6	9
4	Science Exhibition	5	7
5	Science Quiz /Science	5	5

	Seminar/Science Project Competition/Other GUJCOST Programmes		
6	VIGYAN SAFAR/Video Van Programmes, Programmes of Scientific awareness about superstitions	30	45
7	Demonstration of science Experiments (Science School)	40	40
8	Establishment of science Club in school and activities	50	100
9	Communicator's training	-	02

Community Science Centres (CSC) last three years activities

Table 6

Name and Address of Community Science Centre					
2007-08		**2008-09**		**2009-10**	
No. of Programs	**No. of Partici-pants**	**No. of Programs**	**No. of Partici-pants**	**No. of Programs**	**No. of Partici-pants**
O.V.Sheth Regional Community Science Centre, Nehru Udyan, Racecourse, Rajkot-360001					
168	31440	192	21,216	477	47,000
Community Science Centre, Aarti Society, Atmajyoti Ashram Road, Subhanpura, Vadodara-390023					
206	30,134	189	22,272	264	59,995
Kalyan Regional Community Science Centre, BhavnagarPlot No. 2232, 13/A, Daxinamurti Society No.-2, Hill Drive, Phulvadi, Bhavnagar					
224	40,845	361	98,284	422	83,335
M.D.Mehta District Community Science Centre, Darbargadh, Dhrol-381210,Dist. Jamnagar					
561	45,801	551	135,400	483	88,741
Nisarg Community Science Centre, 61/3, GH-Type, Nr. Swaminarayan Mandir, Sector-23, Gandhinagar					
118	40,990	181	32,689	205	59,384
Pramukhswami District Community Science Centre, Badoli, Ta.- Idar, Dist. – Sabarkantha					
45	44,935	59	59,138	143	48,930
Girdharbhai Sangralay District Community Science Centre,Museum and Balbhavan, Amreli-365601					
114	44,343	186	18,204	163	20,794
District Community Science Centre, Chaparda, Ta. - Visavadar, Dist. Junagadh-362120					
284	56,228	308	55,939	415	75,569
C.C.Patel Community Science Centre, Vallabh Vidyanagar, Dist. Anand 388120					
47	7,075	62	5,987	117	22,000
Jay Bharti District Community Science Centre, Sir Sorabji Training College Campus, DIET, Chok Bazar, Surat-395003					
131	35,141	227	66,889	155	81,086
Dr. Homi Bhaba District Science Centre, J. P. Marg-1, Dudhrej Road, Surendranagar					
20	24,578	26	27,287	125	28,090
District Community Science Centre, PalanpurBeside, Kisan oil mill, Laxmipura, Palanpur 385001. Banaskanta					
70	18,183	80	25,889	177	32,800
Punaba District Community Science Centre, C/o Adarsh VidhyaSankul, Patan-384265					
42	48,422	46	18,028	110	24,083
Shree Sahajanand Swami District Community Science Centre, Chhaya C/o Shree Swaminarayan Gurukul, Chhaya Main Road, At-Chhaya, Porbandar-360578					
113	28,471	159	30,983	109	19,341
Prayosha Community Science Centre, Dang Swaraj Ashram Ahwa, Dang-394710					
63	29,088	99	21,245	160	25,127
Community Science Centre, Swami Vivekanand Vidyavihar, Navu Sankul, Opp. Kumar Petrol Pump, Dakor Road, Nadiad, Kheda					
25	3,891	41	15,422	-	-

Kutch Mitra Community Science Center Indian Planetary Society Bhal Bhavan, Khengar park Opp. Hamirsar talav, Bhuj-370001.					
-	-	111	25,332	105	35,310
Param Community Science Center Satyam College of Education Mahila B.Ed. College, Divyajyot Sankul opp. Pritam Socity-1 Bharuch-392002					
-	-	-	-	19	7,925
Manthan Narmada Community Science Center Old Zilla Panchayat Building, Main Market, Ta-Rajpipla. Dist-Narmada					
-	-	-	-	167	51,083

Last three years records

Table 7

Year / No. of	**2007-08**	**2008-09**	**2009-10**
Programs	2,231	2,878	3,816
Beneficiaries	5,29,565	6,80,204	8,10,593

Analytical Study on Theories and models of science communication for Development

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Abstract. During early days, there was no science communication, as such. But as we understand it today, the technology, science and communication existed from the very beginning. There had been a number of turning points during the cultural evolution of man in India, from where we can mark the beginning of science communication, but it is very difficult to pin point a single incident being origin of Science Communication in the country. The evolutionary trends of science communication evolved so far in the country, and the efforts are on to find out newer and innovative modes and ways to communicate and popularize science more effectively and in an interesting manner. Undoubtedly, science communication activities and programmes have progressively developed in India, in terms of quantity. There are science magazines, TV programmes, radio programmes, large number of publications, field activities, exhibitions, interactive programmes, websites etc. to popularize science among people and to create awareness about the science needed for life.

Science communication is integral to every aspect of modern life. Despite generally favorable public attitudes about science, technology, and their benefits, however, tensions continue to emerge at the intersection of core human values and certain scientific fields—from human embryonic stem cell and global climate-change research, to the teaching of evolution (Nicholas, 2000). Increasingly, this tension has interfered with scientific progress, the quality of science education, and the broader ability of the scientific enterprise to fully serve the needs of society.

Understanding of science and technology is an essential pre-requisite for making wise choices in the acquisition and utilization of knowledge resources, which are to be fully deployed towards human development and welfare. Attempts to bring the benefits of science to society require a certain threshold of capacity to understand science and its implications, and to recognize the daily opportunities to make science work for people.

There are many theories and models in science communication to create awareness and to educate the knowledge on science and technology to the public. These theories and models explain the ways of communication and strategy but don’t explicate the message of communication. Science and technology communication are a pervasive presence in our lives. The way we work, communicate with one another, stay healthy, and play are all profoundly influenced by the results of scientific inquiry (Friedman, 1999). In such a world, increasing the public's understanding and appreciation of science and technology is of vital importance. The Science and Technology communication for rural people brings development in socio-economic growth of people which lead to development of nation.

This study is to be done to analyze various theories and models of science communication to understand the concept and its impact on people. And also this study helps to understand the essentialities of science communication for rural development. The traditional approach to dealing with science-society anxiety has been to try to increase public understanding of scientific discoveries and theories. Yet, many members of the public do understand the scientific issues and facts, but find them inedible, and thus, education alone may be an insufficient response.

Effectiveness of Science Communication vis-a-vis Evaluating the Various Interventions

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Abstract. Public communication of science refers to transfer of scientific information by a sender to a receiver in such a manner that both have a common understanding of the meaning and intent of the message. Communication involves many players such as the communicator, message, channel, treatment, audience and audience response. The basic objective of science communication is to lead to action. This objective can only be achieved when communicators ensure that their intervention is effective. Now, the question arises how to determine the effectiveness of communication intervention? Evaluation is the key to determining the effectiveness of public communication of science. Before taking a step forward in this era of Information and Communication Technology where we find unprecedented explosion of knowledge, it is deemed necessary for the various stakeholders associated with communication of science among public to first study the various initiatives taken by different agencies associated with dissemination or communication of scientific information among the client population. Some of them could be media communication, on – line communication, publication activities, direct communication, promotional objects and the like. Evaluation itself is not a step in itself, rather a continuous process to be conducted at various phases; formative evaluation, summative evaluation, process evaluation, product evaluation, context evaluation, impact assessment etc. The paper throws light on evaluation base and methods of evaluation for each of the above communication methods and also discusses about some of the research studies conducted in the area of evaluation of public communication of science. Mention is made regarding the methodologies used to conduct an assessment of communication needs, media use behaviour, effectiveness of various media and media – mixes, usability of websites, content analysis of print media, on-line media used for science communication. A considerable amount of work has been done in the area of evaluation with reference to science communication in the United States, Canada, some of the African countries too. The World Bank has an Independent Evaluation Group which caters to the evaluation needs of various groups. Coming to India, this area is still in its infancy and needs to be taken care of since resources are limited and priorities are to be set. All this can be made true with the efforts of social scientists, development communication experts, mass communicators, information technology persons who can be partners to the cause of evaluation in the field of science communication.

Use of statistical information by Indian journalists: An analysis of articles on scientific research in vernacular press

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Abstract. The news writing about scientific events specially where statistical data is involved is problematic for the journalists of the vernacular press where the languages used in the study and reporting are different. The basic aim of this study is to analyse, as to how the Indian journalists deal with statistical information and how they interpret matters of risk and probability. In simpler words, we aim at analysing the gap between the actual scientific information and the one which is reported in the local press. The study will consist of mainly two parts - selection and analysis of newspaper articles, and interviews with journalists and editors from the news section as well as science journalists. The first, qualitative part of the study explores the kind of articles in which aspects of uncertainty play a part. News coverage of scientific research is very diverse and found in all sections of news papers. Often the word research is also used referring to work in non-scientific settings. Articles and reports appearing in local press, connected to science will be explored for a span of one month. These writings will be analysed followed by a study aiming at finding the role of journalists - how do they select items, what problems do they encounter in writing about scientific research and what are their perspectives in dealing with themes like risk society, uncertainty, probability and statistics. The conclusions will be drawn after a dialogue with journalists, aimed at discovering ways and means for understandable yet truthful coverage of present-day scientific work.

Awareness of Our Politicians About Science

Ashwani Pandey

Abstract. Awareness of our politicians about science–why choose this subject? The politicians are responsible for the development of our state or country as a whole. If they don't know the facts of science and are unaware about them, then how will they develop the society and masses in the state/country? Introduction of legilation is an important body part for growth of science communication. If our leaders become aware about it, then science communication will get a new and productive pillar among the masses. In the process of research we will design a questionnaire containing 10 science related questions. For the selection of politicians to fill up the questionnaire we will choose 10 MLAs and 3 ministers. Along with this we will also choose the 5 ex-MLAs, so that we can understand the role of ex- and present ministers about awareness of science. The questionnaire will be just like this: how many times you have put the subject of science in assembly? Is there any running by the state government? One step again from questionnaire after the completion of questionnaire filling, we will ask for the suggestions to communicate the science and what important steps they shall take to increase the science communication to the masses. In conclusion of research we will make a chart with the help of those questions which we have put to the leaders. That will completely clarify that how much the politicians are aware of science and its communication. After the compilation of suggestions we will create an atmosphere to grow science communication.

[Please check if you want to include this abstract. It is clear the author has not carried out any study so far.]

Engaging with Audiences who are Unengaged on Science

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Abstract. A key challenge for many science communicators, often overlooked, is how to reach out beyond those audiences who are already engaged with science, and get through to those who are unengaged or disengaged with science. Market segmentation research in Australia and the United Kingdom shows that these unengaged may make up about 35 per cent of the public – a not insignificant group of people. This presents a real challenge for contemporary science communication and engagement activities – how do you ensure that you are reaching and hearing from a full representation of the community?

Keywords: Public Engagement, Unengaged, Public attitude research

Introduction

Activities undertaken by science centers, research institutions, the science media and science communicators over the past few decades have, in general, made a significant contribution to raising awareness of science issues across society and increasing science literacy, at least amongst many people.

For there are still substantial numbers of the population, in all countries, who never visit science centers or research institutions, are turned off by science-based stories in the media, and are unengaged on science topics. But while we, as science communicators, collectively know more and more about the segments of the population that are 'switched on' or engaged with science, we seem to know precious little about those who are 'switched off'. Yet without a better understanding of the attitudes and values of these people, they are unlikely to be effectively reached with most science communication strategies.

Australia's Department of Innovation, Industry, Science and Research has undertaken a series of dialogues with recruited members of the public who are unengaged on science, to discover more about their interests and attitudes, sources of trust and information needs. Key findings are that unengaged members of the public have different values, different interests and are differently engaged about science and technology from those sections of the public who tend to be involved in most science communication activities.

So relying on data from people who engage in science communications activities, and extrapolating that across the broad population can be as misleading as taking the opinions and comments of extremist groups on issues such as gene technology or nanotechnology as representative of the broad society.

Indeed, one lesson from public engagement activities on these topics in Australia is that it is difficult to attract and maintain broad public interest in a debate being conducted between interest groups. This is particularly so when the debate is defined by polarised extremes of those passionately for or passionately against the technology; neither of which align well with the broad public interests in hearing a balanced account of the relevance of different applications to their lives.

And this relevance to one's life is doubly significant when seeking to communicate with the unengaged, as the findings have revealed.

Better Understanding the Segments

While different countries will have different attitudinal or behavioural segments of the public in relation to how people relate to science and technology, the findings of two recent studies serve well to show the types of audience segments that can exist.

A UK study undertaken in 2008, *Public Attitudes to Science 2008 – a Guide*, prepared for the Research Councils UK and the Department for Innovation, Universities and Skills, found five key segments [1]. These were:

1. ***The Confident: 20%***
   The most interested and most positive about science, most informed about science and most highly educated.
2. ***The Less Confident: 25%***
   Very concerned about change and felt that science and scientific development was out of control. They feel poorly informed about

science. Nearly half were over 60, and this segment had the lowest level of education.

3. ***The Sceptical Enthusiasts: 12%***
   Had a positive outlook on life, liked learning new skills and had a wide range of interests. They were also positive about science. However, they were sceptical about authority.
4. ***The Distrustful: 20%***
   Lacked trust in Government and authority. Not very interested in science and worried about certain scientific developments. This segment was on average younger than the general population. A significant number were women.
5. ***The Indifferent: 20%***
   Had a limited understanding of science and were not concerned about its control. Highest proportion of parents with children under 16, with a small proportion of people educated to degree level or higher.

Based on this audience segmentation study, as much as 40 per cent of the UK public could be categorised as unengaged or disengaged with science. This might of course vary issue to issue, and not preclude them from taking part in some science debates, but they were in general not very interested in science.

In Australia, the Victorian Department of Innovation, Industry, and Regional Development conducted a similar segmentation study, based on attitudes and behaviours in seeking information on science in 2007 and 2010. The report, *Community Interest and Engagement with Science and Technology in Victoria*, found six key segments [2]. These were:

1. ***Interested/not active: 23%***
   Interested in science but not active in searching for science information. This was the segment with the oldest average age.
2. ***Interested/active: 27%***
   The True Believers! Interested in science, active in searching for science information and able to find information they can easily understand. Most work full time, are well educated, early adopters, attend science events and follow science stories in the media.
3. ***Interested/active/can't find: 16%***
   Interested in science, active in searching for science information but unable to find it or have difficulty understanding it. They want more information on science, watch science documentaries, and want science explained in simple terms.
4. ***Neutral / not searching: 8%***
   Many female, do not want to know more about science, have other interests. Neutral towards science and not actively searching for science information.
5. ***The Indifferent: 20%***
   Have a limited understanding of science and are not concerned about its control. This segment had the highest proportion of parents with children under 16 and only a small proportion of people educated to degree level or higher. Predominantly female, do not enjoy science in the media, nor care how things worked. Felt technology was out of control, and had very black and white views of morals.
6. ***Disinterested/searching: 8%***
   Neutral or disinterested towards science but active in searching for science information. The youngest average age, with many sub-groups and 'fringe dwellers'.

By this analysis, about a third of the population surveyed was unengaged in science. This led the National Enabling Technologies Strategies' Public Awareness and Community Engagement program within the Federal Innovation Department to try and find out more about the specific traits of this group. Subsequently the Department held four 'nano-dialogues' in different cities around Australia: Adelaide, Melbourne, Wollongong and Brisbane, on the topics of water, science citizenship, bionics and new materials [3]. The discussions were all framed by topics that were not primarily about science, even when scientific expert input was available to the groups.

The objectives of the nano-dialogues were to explore ways that people not interested or engaged in science and technology might come to talk about it [4]. A market research company recruited eight to 10 people per group, using the segments from the Victorian government's study, without informing participants of the exact topic of the matter to be discussed.

The moderation methodology was one of minimal steering, to allow the groups to chart their own directions. This enabled the participants to lead the discussions more than would happen in a focus group, and allowed them to frame the technologies in terms of their own ways of thinking. The result was that discussions frequently moved towards topics related to the type of world we want to live in.

Key Findings

The key findings from the nanodialogues so far have been that the values, interests and levels of awareness in science and technology issues among the disengaged and unengaged members of the public are quite different from those sections of the public who tend to self-select to attend most information or engagement activities. In particular, they often have had poor experiences with science at school that has turned them off the subject. This suggests that the school years are the most crucial point for science education or communications intervention. Other findings included:

- Typically, interactions with S&T were not immediately visible, recalled nor valued,
- Many used and valued using a range of technologies, although not all were mobile phone and internet literate,
- They tended to seek information on science and technology issues primarily from friends and family, with little reference to experts,
- They weren't generally interested in knowing the science behind how something worked, rather all they needed to know was that it worked and would solve a problem, and
- They responded to science and technology discussions overwhelmingly in terms of application.

This was well demonstrated by an excerpt from one of the groups:

Moderator: "Nanotechnology – has anybody heard of that term?"
Participant 1: "Sounds like an iPod."
Participant 2: "If I was sitting on the train reading that I'd just turn the page because I'd presume it was over my head."
Moderator: "How do we not switch you off? Does telling you what it does get your attention better than using that term?"
Participant 2: "Don't use that term and I'll be alright"
Participant 3: "Tell me how I'd use it in my own home."

Likewise people who expressed no interest in science nor technology were willing to engage in discussions about water recycling, climate change and cars, as long as discussions were framed in terms of uses. This demonstrates that for the unengaged segments of the community, science discussions sometimes need to not be about the science itself, but how it is used and why. Non-science science communications.

Other findings from the groups reinforced values-based science communications principles that:

- When information is complex, most people make decisions based on their values and beliefs,
- People seek affirmation of their attitudes (or beliefs) – no matter how fringe – and will reject any information that is counter to their attitudes (or beliefs),
- Public concerns about science and technologies are almost never about the science – and scientific information therefore does little to influence those concerns, and
- People most trust those whose values mirror their own.

Conclusions

While this research is only a start, and more work needs to be undertaken to discover how different science and technology issues are viewed (or not viewed) by unengaged members of the public, it is useful to show that the unengaged can be engaged in science discussions if they are not framed as being about science. Of course different countries will undoubtedly have different segments of values, attitudes and behaviours towards science amongst their populations, but it is necessary to find out exactly what they are to understand how many might be unengaged, and what might best engage them.

The findings of this small study indicate that unengaged segments of the population tend to have quite different attitudes, values and sources of trust on science and technology, and therefore quite different communication, education or engagement strategies will be needed to best reach them.

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Impact of Public Communication of Science and Technology on the Indian Society–Development of An Assessment Framework

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Abstract. There is a wide recognition that communication of science and technology plays a central role in the socioeconomic, cultural, and environmental development of any country. It has been a continuous national endeavor both by the governmental and the non-governmental organizations to infuse scientific temper in the society, thereby building a nation of scientifically aware and scientifically thinking people.

In 1980, science communication was given prominence in India's VI[th] Five Year Plan and two years later the National Council for Science and Technology Communication (NCSTC) was established with a mission to communicate science and technology, stimulate scientific and technological temper and coordinate and orchestrate such efforts to create excitement concerning advances in science and technology, to enable informed decision-making at the grass root level and to encourage intelligent debate on developmental issues. Social impacts of such activities cover a wide spectrum from behavioral/attitudinal changes of the individual to the alterations in the way people live, work, play, develop skills, relate to each other and organize their communities and institutions to meet their needs and guide their collective actions, as well as changes in their characteristic values, beliefs, norms, traditions and perceptions of quality of life and well being. Although much has been achieved, there is still an urgent need to make science communication activities more effective, both in terms of quality and quantity.

In this context, a study had been undertaken to design an impact assessment framework for the NCSTC-Network to assess the effects of public communication of science and technology impacted on the society from both theoretical and empirical angles. The proposed/suggested framework aims to clearly link and, if possible attribute, impacts in behavioral and attitudinal change on the ways in which the stakeholders organize, operate, work, and collaborate to fulfill their respective or collective goals/needs like knowledge gained/diffused, skills developed, awareness and understanding enhanced, contacts and network formed, confidence and credence developed through such activities.

Keywords: Framework, Impact assessment, NCSTC-Network, S&T communication

Introduction

Science and technology is an integral part of the socio-economic developmental process of a country (Ahmed and Stein, 2004). It seeks to build the understanding, skills and knowledge base of individuals and institutions. The importance of science and technology to modern societies and the role of a technologically educated population in promoting social and economic development has long been recognized (United Nations, 2002, 2002a). Science and technology communication is broadly understood as the system of measures aimed at the dissemination (Libutti and Valente, 2006), appropriation and valuing of science and technology goods (Martinez, 1999; Simon, 2009) which include critical thought, ideas and values (Burns *et al.*, 2003; Treise and Weigold, 2002), history and sociology of scientific knowledge, how science is practiced and the results of scientific research and technological development (Abreu, 2004; Lee *et al.*, 2005; Miller, 2004).

The communication of science and technology plays a central role in the socioeconomic, cultural, and environmental development of any country (Miller *et al.*, 1997; Rogers, 1976). In socioeconomic terms, the communication of science and technology makes it possible to spark new vocations and encourage talent for scientific research, technological development, and intellectual endeavors in general (Miller, 1995, 1998, 2004; Miller and Kimmel, 2001). It fosters creativity and innovation contributing in the production of better trained human resources, expands social opportunities and strengthens the educational system. Culturally and environmentally, the popularization of science enhances the critical sense of the population, by increasing its involvement in decision-making and contributing to democratic stability and sustainable development (Ahmed and Stein, 2004; Powell and Kleinman, 2008).

It has been a continuous national endeavor both by the governmental and the non-governmental organizations, to infuse scientific temper in the society, thereby building a nation of scientifically aware and thinking people (Mazzonetto, 2005). Despite the efforts, many citizens remain ill-informed about scientific advances. For example, an analysis of survey results aimed at determining civic scientific literacy indicates that only slightly over 10 % of the population of 14 industrialized countries has a good understanding both of scientific concepts and methods (Miller, 1996). Various agents are involved in popularizing science, each with different roles and functions. Therefore, popularization of science requires integrated action by knowledge producers, such as scientists, researchers and intellectuals, and knowledge disseminators, such as journalists, publicists, museologists, teachers, audiovisual aid producers, and members of scientific, cultural, and social institutions.

In India, NCSTC-Network has been doing pioneering work in this direction for the last twenty years with the objective of science and technology communication. It endeavors to communicate science and technology, stimulate scientific and technological temper and coordinate and orchestrate such efforts to create excitement concerning advances in science and technology, to enable informed decision-making at the grass roots level and to encourage intelligent debate on developmental issues. National Teacher's Science Congress and National Children's Science Congress are regularly being organized to enlighten both the teachers and children to share critical review of science education and to relate the learning of science to their immediate social and physical environment. Several schools, colleges and Non Governmental Organizations also contribute considerably in this perspective. Apart from these two programmes, NCSTC-Network has also organized several other programmes such as Year of Scientific Awareness-2004, Appreciating Physics in daily life-2005, Understanding Planet Earth Programme-2008-09 and also activities during the first run of the Science Express which was started on October 2007 and ended on May 2008.

Social impacts of such programs include changes that affect individuals, groups, communities and populations as well as the interactions between them. They are alterations in the way people live, work, play, relate to each other and organize their communities and institutions to meet their needs and guide their collective actions, as well as changes in their characteristic values, beliefs, norms, traditions and perceptions of quality of life and well being. In this short span of twenty years, NCSTC-Network has several accolades to its credit. Its activities have different effects on the audience with different impacts. It has developed a network of around 70-80 strong S&T based members to propagate its mission/goals and to help it in planning various activities. However, in spite of all efforts, there still exists a huge gap between the desired and the actual social perceptions of scientific knowledge. Little studies have been carried out to measure and evaluate the civic scientific literacy and impacts of science and technology communication programmes being performed by the NCSTC-Network.

The present study aims at designing an impact assessment framework for the NCSTC-Network from both theoretical and empirical angles taking into account various activities/programs performed by the network members. Although, rigorous analyses can be performed, it will be appropriate to mention that the methodologies/framework adopted/suggested would be 'indicative' in nature.

Methodology and Approaches

Selection of programmes

As a preliminary step in the application of impact assessment study, selection criteria has been applied to shortlist the S&T communication related programmes for which societal impacts are easily visible along with available data. Two major programmes performed and executed by the NCSTC Network *viz.*, National Teacher's Science Congress (NTSC) and National Children's Science Congress (NCSC) have been considered in the present study, though they are conducting several other programmes during this twenty years of time, *viz.*, Year of Scientific Awareness-2004, Appreciating Physics in Everyday Life- 2006, Understanding Planet Earth Programme-2008 & 09.

Background analysis

Background analysis is the preliminary step to determine whether social effects are likely to occur as a result of the proposed programme. Background analysis has been performed to identify as many as possible of the user groups and communities that may be affected by the action. Various clues to the nature and intensity of possible social impacts obtained from different stakeholders and network members participating in the process have been recorded.

Data collection strategies

Data collection is not only a very challenging job but also labour intensive, time consuming and expensive. A brief description of various kinds of data collection strategies which can successfully be explored to capture the science communication activities performed by the NCSTC Network is presented below:

1. ***Case studies:*** Case studies are a structured and detailed investigation of an organization. They are designed to analyze the context and the processes involved in science communication. The questions asked and methods used generally differ from case to case, so they cannot be considered strictly comparable. Because case studies are in-depth investigations, they can make good use of any combination of different evaluation tools, including direct observations and reviewing existing documents.

- ***Direct observations:*** This tool is particularly useful in assessing scientific awareness built. It highlights the potential value of enlisting external experts to observe an organization's activities and facilities, and how they are mobilizing people from scientific capacity building perspective. Internal staff and managers are often so familiar with the organizational environment that they no longer notice good or bad aspects of the organization. An outsider with knowledge of similar organizations might see these immediately. This tool can be particularly effective when combined with self-assessment.
- ***Review of existing documents:*** Archives, websites, annual reports, budgets and minutes of meetings are an indispensable source of information and a good starting point for discussion about the impacts of science popularization activities. They also provide a focus for the collection of additional information. If records are well kept and complete, they can provide essential quantitative information about inputs to scientific awareness building, staffing issues, remuneration and working conditions, the utilization of resources, and the overall performance of an organization over time.

2. ***Interviews:*** Interviews can be conducted to obtain more detailed information on aspects of the science communication activity. Interviewees can be selected on the basis of their responses to survey questions, an affiliation with important interest groups or expert

knowledge. Different types of interview methods can be used to elicit different kinds of information.

- ***Self-assessment workshops:*** Self-assessment workshops provide an extremely useful means of gathering and analyzing information from organizational science communication initiatives and interpreting results. They also help to build awareness and commitment to the evaluation and support the validation and enrichment of information, conclusions and recommendations. High-level facilitation skills and the proficient utilization of tools for group analysis, synthesis of findings and reporting of results are essential for the successful implementation of these workshops.
- ***Key informant interviews:*** Key informant interviews are generally in-depth, face-to-face discussions with individuals selected on the basis of their affiliation with certain interest groups, or because they are regarded as particularly experienced, insightful or well informed. This tool enables evaluation specialists to capture the views and expectations of stakeholders, such as staff members, clients and end users, concerning awareness-building efforts and changes in scientific rationality and performance over time. These interviews with individuals who are part of the organizational supply chain can also provide important insights into why changes did or did not occur.
- ***Group interviews:*** Group interviews lie somewhere on the continuum between key informant interviews and self-assessment workshops. If competently facilitated, group interviews can capture consensus views of relatively homogeneous groups. They are less appropriate with more heterogeneous groups or when certain individuals tend to dominate the conversation.
- ***Personal histories:*** It is particularly useful when the evaluation covers a long period and/or documentation is limited. Personal histories can capture the perspective of key players concerning the history of an organization, their own personal and professional development.

3. ***Surveys:*** The questionnaire survey is probably the most frequently used tool for collecting information for evaluations. Surveys tend to be time- and resource intensive, however, require specialist skills for the preparation of the survey forms, sampling techniques, administration of the survey, management of databases for quantitative and qualitative information, statistical analysis and research. They may also require translation into a number of local languages, in which case the results then have to be processed in those languages and reconstituted into a single set of results.

Questionnaire surveys are an extremely useful tool in science communication evaluation. They can be used to identify the skills and knowledge gained as a result of training, workshops, conference activities and what skills they have been able to use on the job. Ideally, surveys are conducted:

- before training, workshops, conference to establish baseline capacities
- on completion of training, workshops, conference to assess capacity built
- post training, workshops, conference and return to the work environment to collect information on capacity utilized
- some time after to assess the impact of the training, workshops, conference.

Selection of variables

Selection of variables depends to a large part on the availability and reliability of data. The researcher undertaking the analysis will establish standards and criteria for the analysis after reviewing data and considering the time and effort needed for the analysis. The goal of variable selection is to select social factors, from those in the baseline studies, that can be measured in a quantifiable way, thus ensuring that the analysis and assessment can easily be replicated and increasing the objectivity and defensibility of the analysis. Qualitative data is normally used to supplement and interpret the quantitative one. In some cases, information will be primarily qualitative supported by one or two quantifiable variables. Development of matrices of variables, the baseline case and alternative scenarios is often the simplest way of showing social change and social impacts. The selection of the key sub-variables from each general category should meet the general standards and criteria such as relevance to the analysis; significance; availability; efficiency; sensitivity; accuracy; and validity. However, without adequate baseline data and careful analysis, an impact assessment does not provide the decision-maker with assessments which help understand long term impacts. Availability of historical time series data can provide further objectivity and clarity to impact assessment studies.

Identification of indicators

Identification and selection of indicators is one of the most important steps in the impact assessment process. Care must be taken to ensure that the indicators identified actually reflect the potential social effects. Further, the indicators are issue-driven and reflect issues that arose prior to the impact assessment process. Indicators selected should articulate the dimensions of the social system. The indicators associated with the issues can be utilized as major analytical backgrounds for impact assessment studies.

Design of framework / model

Variables, indicators and tools can be integrated into an analytical framework to develop a viable impact assessment framework covering a wide spectrum of impacts through qualitative and quantitative estimation relating to productivity and efficiency effects on NCSTC Network and broader impact on the societal welfare etc.

Suggested Framework

Impact assessment framework

The impacts of NTSC and NCSC which facilitate a wide platform to exchange views on scientific education and enlighten the teachers and students sometimes seems to be overlooked due to shortcomings in attributing/observing benefits of the conference, training workshop, plenary session and exhibition being conducted by the NCSTC - Network. For example, the exposure of the teachers of rural area to such national event and interaction with educationists of country give them new ideas to teach the students more effectively. However, attention is rarely paid to elucidating and substantiating the assumed linkages between the above activities and the intended or observed impacts on society.

The proposed framework aims to clearly link and, if possible attribute, impacts in behavioral and attitudinal change on the ways in which the stakeholders organize, operate, work, and collaborate to fulfill their respective or collective goals/needs like knowledge gained/diffused, skills developed, awareness and understanding enhanced, contacts and network formed, confidence and credence developed through such activities.

The framework has three parts:

- ➢ The analytical framework presents the array of pathways through which generation of scientific awareness by way of investments in different activities of the NTSC and NCSC can result in nurturing a sufficient pool of knowledge intensive human resource. The focus is on the teachers and students. However, the benefits accruing to other individuals (like backward communities in the society) flowing indirectly from these activities can also be identified for estimation.
- ➢ Applying the framework requires assessing what can be measured, how the data can be analyzed and assigning the responsibilities for measurement and analysis. While the goal is to measure impact flows, this may be too costly or, where the pathways are indirect, too complex, so other evidence of impacts should be identified for collection.

➢ Tools for estimating impacts are the third part of the framework.

Fig. 1 summarizes the impact framework.

The analytical framework

The analytical framework set out here focuses on evaluating the impacts attributable to NTSC and NCSC activities. This requires mapping the pathways from the science communication to impacts. These pathways may be direct or indirect, strong or weak, and certain or highly uncertain. The mapping should seek to classify the pathways identified according to these criteria.

Application of the analytical framework is the first step in valuing impacts considered attributable to the conference, training workshop, plenary session and exhibition being conducted by the NCSTC Network. Evaluation of benefits is generally easier when the pathways are direct, strong and certain. However, even when they are indirect and somewhat uncertain, a good case should be possible for SWOT analysis if data is available.

The analytical framework is presented in Fig. 2. It shows an array of potential pathways for a range of NTSC and NCSC activities. The framework aims to identify the changes at each level. Working from bottom to top, these changes are as follows.

1. NTSC and NCSC inputs:

❖ Expenditure on conference, training workshop, plenary session and exhibition by suppliers and participants, including the value of time and in-kind support

2. Capacity built in the individual teacher/student/participant. This may include:

❖ knowledge gained
❖ skills developed
❖ awareness and understanding enhanced
❖ contacts and network formed
❖ confidence and credence developed

3. Capacity utilized by the organization from which the participants take part. The change in practice and/or behaviour resulting from the utilization of new experience built could include:

❖ training of other staff, which in turn leads to:

i. application of the capacity to work to improve quality, effectiveness and/or efficiency of service delivery, policy advice
ii. utilisation of new technologies
iii. greater networking, accessing information, improved communications etc.

4. Impact on the clients (teachers/students) arising from capacity utilized. These can be:

❖ observable changes in low cost innovation techniques employed by teachers, and/or
❖ changes in the operating environment where teachers educate the students in school or colleges.
❖ changes in skill and problem solving capacity among the students to meet the needs of the society.

5. Observed benefits and external factors:

❖ the benefits accruing to teachers, students and other stakeholders (backward communities) as a result of the newly adopted scientific knowledge.

Applying the Framework

This section of the impact assessment framework guides the user through five steps for applying the framework. These steps map the pathways and establish the means by which the validity of the identified changes can be substantiated:

1. utilise the framework to identify the changes occurring as a result of conference, training workshop, plenary session and exhibition (map the pathways)
2. determine the measures and indicators required to verify the identified changes
3. establish the data required for the measures and indicators, verify the availability of these data from appropriate sources and select the most appropriate tools for the collection and analysis of the data

4. determine the extent to which benefits can be attributed to the capacity-building activity
5. assign responsibilities for data collection and evaluation and reporting.

Tools for estimating impacts

The intended impacts to be effected on the society have been explicitly expressed in the NTSC and NCSC programmes itself. Examples of the potential measures and indicators of this change in the scientific awareness, as well as the data required, the data sources and appropriate evaluation tools are outlined in Table 1.

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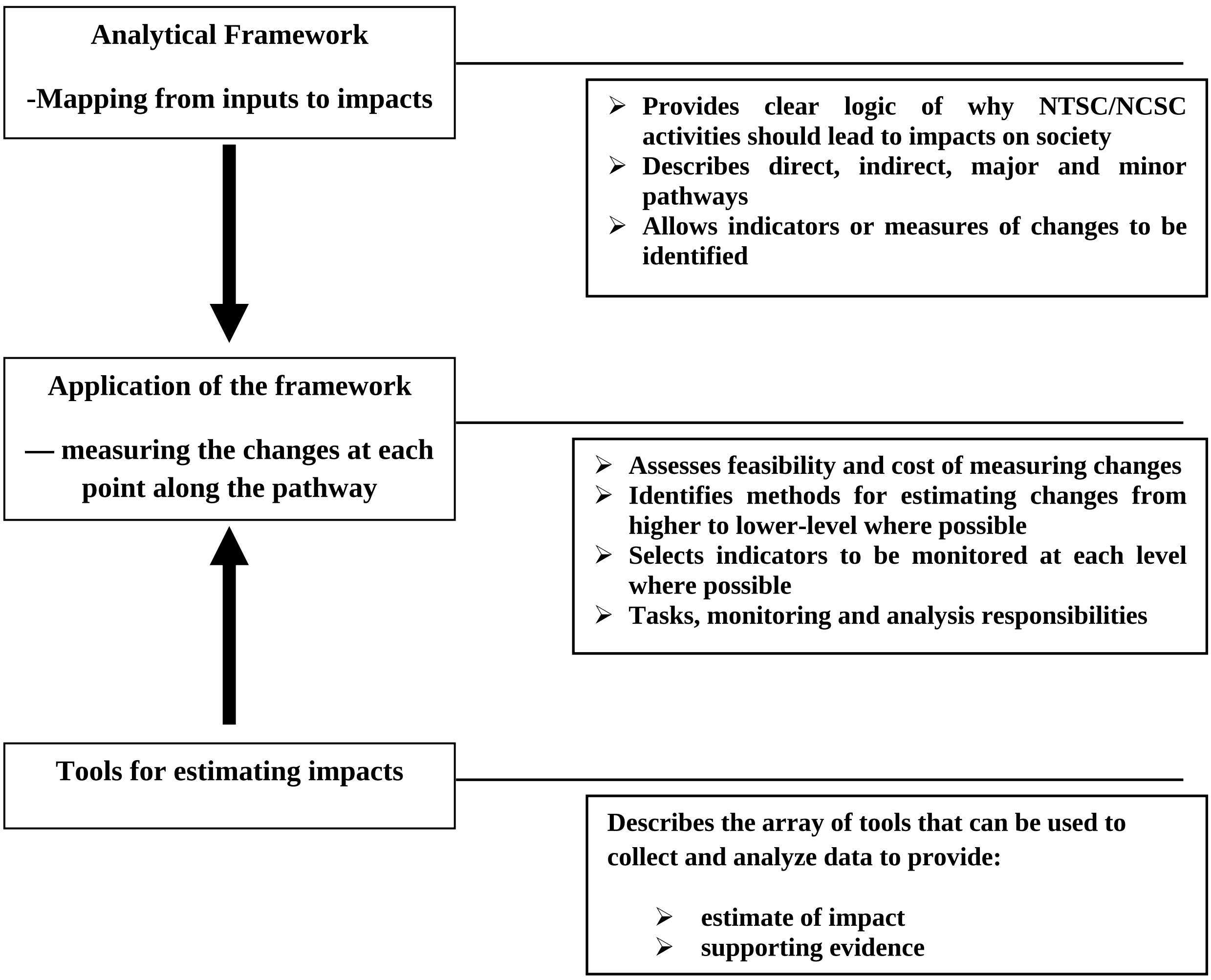

Fig. 1. The Impact Assessment Framework

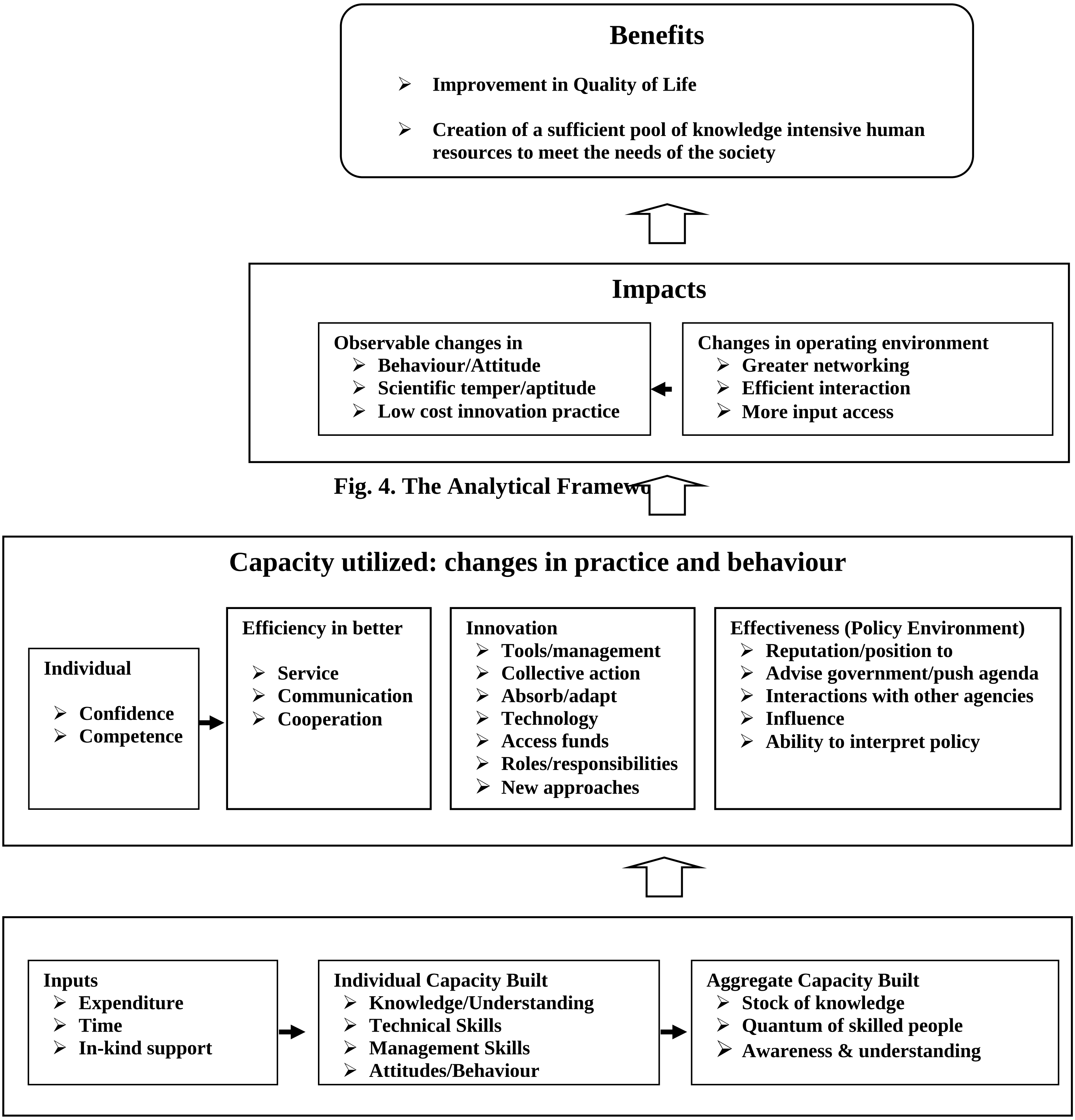

Fig. 4. The Analytical Framewo

Fig. 2. The Analytical Framework

Table 1. Potential indicators and tools for estimating impacts

Indicator	Data required	Data source	Tool
Quantum of scientific temper built (knowledge gained/skill developed/ awareness and understanding enhanced/ contacts and network formed/confidence and credence developed etc.)	Existing capacity: sum of study years plus years of experience Capacity added by conference, equivalence to experience etc.	Records kept by NCSTC involved in relevant work in target area(s); Previous similar estimates Expert opinion	Document review Key stakeholder interview
Quality of conference, training workshop, plenary session and exhibition etc.	Assessment of content of conference, training workshop, plenary session and exhibition	NCSTC/Conference sessions	Expert document review
Attendance	how many participants/how many sessions	Attendance sheets kept by the organizers	Document review
Quality delivery of Conference/Workshops etc.	Participants opinions	Participants	Post-training survey
Participants satisfaction	Participants opinions	Participants	Post-training survey
Quality of Reports to stock of knowledge	Reports to stock of knowledge	NCSTC	Expert review

Not Just a Coffee: Science Cafés as Low Budget but Potentially High Impact Tools of Science Communication

The Case Studies of the Czech Republic and South Tyrol

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Abstract. Science cafés are currently organized in many countries. This low profile, low budget format could significantly contribute to shape the advancement of scientific culture within a society. However, turning a science café into a successful science communication tool is not a trivial exercise. This paper combines the experiences of two different organizers of science café event—the first is private research centre (European Academy of Bozen/Bolzano in Italy) and the second is a non-profit organization (Civic Association Otevirame in Czech Republic). The primary aim of this study is to share best practices in the organization of science cafés in order to help potential organizers in other countries and to compare experiences.

Keywords: Best practice, communication, culture, Czech Republic, events, Italy, participatory discussion, science, science cafés.

Introduction: What is a Science Café?

The science café (or *café scientifique*) is a very simple and low profile format for the public communication of science. Started by Duncan Dallas in Leeds (UK) in 1998 on the basis of the French *"café philosophique"*, nowadays it is difficult to keep track of all the initiatives worldwide (The Café Scientifique Homepage contains 116 contacts in Europe alone, but not all science cafés are mentioned).

The basic principle of a science café is very simple. A science café is an informal meeting of scientists and the general public. It takes place in a public café, where plain language, an inclusive communication style, good drinks and (sometimes) music combine to create a welcoming and comfortable atmosphere. Each meeting focuses on a specific topic, selected from all scientific disciplines.

There are many variants of the basic science café. Some organizers invite a facilitator who interviews the scientists and moderates the interaction with the audience; others just introduce the speakers, who briefly present their topics on their own (5 to 20 minutes each), followed by a pause and a period of questions and comments from the audience. Some science cafés invite scientists only; others propose an interdisciplinary look at a topic by inviting artists, business men, writers and so forth.
In some venues, speakers are allowed to show Power Point presentations or videos; other organizers exclude all formats except storytelling.

This paper documents how two different organizers with two different backgrounds are approaching the organization of their science cafés, and, by sharing their experience, the authors explore some of the reasons that make the science café an interesting channel of the public communication of science. The two case studies are the science cafés held in Prague, Czech Republic, and in Bolzano, Italy.

The science cafés in Bolzano, South Tyrol, Italy began in 2005, organized by the Scientific Communication Department of a research institute called the European Academy of Bolzano/Bozen (EURAC). Conceived as a public relations strategy, they have grown more and more to become an important tool in the citizens' debate process. Fifty-five events have been organized so far. In 2008, a supplementary edition of the science cafés took place in cooperation with the local Innovation Park (TIS).

Beginning in 2008 in Prague, the Science Café Czech Republic has become a veritable brand, overseeing meetings in five towns of the Czech Republic. Science Café Czech Republic is a voluntary, non-profit project. The idea for the initiative originated with two friends in the autumn of 2007. After founding the unincorporated association Otevirame, the first-ever science café took place in Prague on November 11, 2008, around the topic of Mars exploration. Its motto is “Science as an adventure”.

Successful Ingredients

Comfortable venues, smart topics, qualified guests, professional moderation, regular scheduling and a simple but effective advertisement campaign: these are the ingredients for a successful science café. Quantities and proportions might vary from place to place according to available funds and to personal taste.

he following hints are summaries of experience gained in Bolzano and Prague and could be used as “How-To” manual for potential science cafés or serve as a basis of comparison with the experiences of other organizers.

Venue

Finding the right venue for the event is an important step to making science cafés happen. The venue may be the cafeteria of a university or research centre (especially in case where the institution organizes the science café), but never a conference room or similar formal space. Science cafés are all about the right atmosphere. It is essential to find a venue where this atmosphere can be created easily and where the people – both the guests and audiences – are feeling comfortable. The ideal venue is a mid-sized café that is easily accessible by public transportation. Based on the experience of the science cafés in the Czech Republic, it is not difficult to find such a café and make an equitable arrangement with its owner: science cafés bring new customers to the café. Indeed, visitors and guests need some refreshment while chatting, and some might even return to the establishment on their own. It is a golden rule to pay for speakers’ drinks and some snacks might be offered to visitors, but generally visitors pay for their own drinks.

In Prague, the meetings are held in a café (which is also a small theatre) near the downtown core. There’s no admission fee, but in some other cities in Czech Republic, entrance to the Science Café costs 50 CZK (2 EUR), which covers travel costs and refreshments for the speakers (scientists).

The EURAC science café of Bolzano/Bozen takes place on the terrace of the internal cafeteria. The organizers offer snacks to the audience and pay for twenty free drinks per night for guests and collaborators. (The barman even invented special drinks, prepared only during the science cafés, to animate the atmosphere on these evenings.)

Scheduling

It is important that people get used to a consistent schedule of science cafés, so that it becomes a regular monthly or weekly program akin to a regularly-scheduled football match or theatre outing. Dates are established several months in advance so that the audience, organizers, and café owners always know when the next meeting will take place. The Czech Republic Science Café, for instance, is held on a monthly basis, every second Tuesday, beginning at 7 pm, except during summer holidays. Science cafés can take place also weekly in a specific season, which is the case of the EURAC science café (every Wednesday during the summer, beginning at 8:30 pm).

Topics and Guests

There is no golden rule as to which scientist to invite or which topic to choose—any scientific discussion can inspire a science café.

In Bolzano, the starting point of the EURAC Science Café are the current projects of researchers from the research center’s different institutes—from genetic medicine and remote sensing to minority rights. The topics are presented so as to stimulate local public opinion about the connection between research and people’s daily lives. Suggestions of topics from citizens, partners and other science café organizers are always very welcome.

The organizers usually invite at least two guests, in order to encourage discussion. A few combinations are possible: scientists defending conflicting theories, a scientist studying a local situation in contrast with a scientist coming from another context, experts with different backgrounds speaking about the same topic (for example, an historian and a geographer talking about climate change).

In the Czech Republic, the organizers choose their topics and scientists according to their own preference, as well as by recommendation and input from experts and journalists. In the selection of speakers, organizers make sure they are true experts in their field of interest. Popularizing serious and professional scientists and research activities, science cafés generally avoid inviting guests for whom science is a hobby.

Science Café Prague recommends inviting more than one guest, since not only can they complement one another, but they may even save the evening (if one of the two doesn't turn up).

Both organizers have had fruitful experiences with an interdisciplinary discussion of a topic, inviting, for example, business people, artists, writers, and, most importantly, consumers of science.

Facilitation

Good facilitation of science cafés is key to a successful event. A professional facilitator/host who interviews the scientists and moderates over the discussion (for example, a scientific journalist) can be very useful, particularly when the topics are controversial. However, this might incur an additional cost. A cheaper option would be to elect the host from within the organizing team.

In Prague, each science café starts with a short introduction by the host of the event. He/she introduces the speakers and the agenda for the evening. It is also good to mention the basic rules, the length of the meeting, and how the audience can participate in the discussion. Speakers usually start with a presentation of their topics in short speeches, without the intervention of a facilitator. Organizers discuss with them in advance what they are going to talk about, so that their presentations do not overlap but rather complement one another. After a break, the floor is given to questions and comments from the audience. At the end, it is the host who wraps up the event.

In the EURAC Science Cafés, the role of the facilitator is a much more crucial one. Indeed, speeches by the experts are not planned, in order to break every possible link with a formal lecture or conference. The facilitator interviews the guests, giving the discussion the desired direction, and gradually involving the audience. It is fundamental that the facilitator meets with the invited guests before the science café. He/she does not need to be an expert in the topic they will be talking about. However, he/she must be very sensitive in order to assimilate input from experts and visitors and, bearing in mind the starting topic, keep the focus on the evening's theme. The role of the facilitator is crucial in the case of sensitive topics such as genetically modified organisms or renewable vs. atomic energy.

It is the host who decides when it is appropriate to end the discussion. Depending on the participation level of the audience, discussions may take from one to a few hours.

In Prague, a three-hour debate with a long questions-and-answers session can be a common occurrence. In Bolzano, the public discussion is always wrapped up after one and a half hours. The invited guests are informed well in advance to reserve a good amount of time, however—an avid public can continue the discussion with them in a less formal way after the session officially ends.

Advertising

Bringing together people of all ages, science cafés are often attended by enthusiasts regardless of the topic discussed—they simply love the idea of a science café, since they always learn something new. That's why once you gain a new audience member, you gain also a new promoter. The best promotion is the cheapest: word-of-mouth.

The Internet is a good friend of science café organizers. Up-to-date websites, social networks like Facebook or Twitter and regular newsletters are very effective and low-budget promotional tools (it takes just few clicks to create a Facebook "Fan Page"). Science Café Czech Republic has a profile on Facebook with more than 600 friends, and the community is growing quickly. Newsletter mailing lists are very important as well. EURAC reaches over one thousand subscribers. In particular, in summer of 2010, EURAC Science Café launched a successful campaign: instead of handing out the usual sheets to collect e-mail addresses, the organizers handed out "keep-in-touch" cards, colored business cards that the public filled out and returned. On the first night they collected the same number of contacts they had collected in the whole season the previous year.

Guests are invited to publicize the science cafés on the homepage of their institutions and the PR departments of the respective universities can promote the event as well.

Posters and leaflets are traditional, good communication channels too.

Merchandise can be fun and can be used as a promotional tool. Cups, napkins or sugar-sachets, t-shirts, tray-mats and other items with the

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science café logo can be used in the café during the meeting and sold to the visitors. The money covers the production costs and the promotion itself.

Cooperation with regional media can be obtained for free. A simple press release and a phone call few days before the event guarantees that broadcasters announce the events on air and/or in newspapers event calendars.

EURAC Science Café cooperates with two radio stations. At the beginning of the summer, the local office of the national broadcaster RAI devotes a whole program (one and a half hours) to announce all upcoming events. Another smaller radio, Radio Tandem, broadcasts a 20-minute-summary after every event. Science Café Prague has a similar agreement with the national radio, which records the whole discussion and then broadcasts it in its "Weekend University" radio program.

Both organizers produce in-house promotional videos, interviews with guests and/or summaries that are uploaded on their homepages and on social networks such as Youtube. The EURAC science café's Youtube channel counts on average 1,400 visits per season.

Pictures taken during the meetings are published online too; people love looking for themselves and friends in albums of public events. Organizers must take care to inform the audience and guests according to local privacy laws.

Technical support

Unless you want to tape a science café in order to submit the recording to a broadcaster or podcast it on the web, you don't need microphones. The audiences are not that big, venues are mid-sized, and everyone can hear each other without amplification.

In Prague, speakers sometimes use Power Point presentations or show videos; in such cases the organizers must provide a projector and a screen (or a simple white wall).

In Bolzano, scientists are encouraged to talk with the audience; they make no presentation but they directly answer the questions of the facilitators. Sometimes a cartoonist interprets the discussion visually, so a surface for his/her drawings is provided as well.

Hands on… the Scientists

"Don't you think your research is controversial from an ethical point of view?", "Would you sell the results of your studies?". These questions were asked of a geneticist during a science café about medical research on neurological illnesses.

Ideally, each science café focuses on one major topic only—selected from the natural or social sciences. Organizers must narrow it down with the guests' specializations and link it to current topics. The title of the science café and a short introduction should make clear to guest speakers and the public what to expect. However, the guests should be quite flexible in their approach. Audiences are often very interested in the personal point of view of the researchers about a topic and in the way scientists do their work.

The goal of the science café is to portray science in a new and informal way. Since not all scientists are aware of this objective, it is useful to remind them they are not going to be giving a university lecture to informed students, but rather partake in an informal discussion with non-experts interested in science. Speaking about his or her own personal experiences and personal opinions makes the career of the scientist more tangible. Scientists are sometime encouraged to bring an object dealing with their research—it could be something from the laboratory, a gadget or an artifact.

Science cafés can train scientists to interact with the public: sometimes they receive stimulating input by non-experts who look at their projects with 'neutral' eyes.

Hands on… the Audience

A science café can definitely be called a success if it is attended by 100 visitors or more. On the other hand, such a large crowd will not be conducive to discussion. Based on the authors' experiences, the most successful science cafés are attended by smaller groups, on average 50 people (a mix of students, professionals, journalists and seniors). That number and composition of attendees enabled true dialogue and interaction between scientists and the public. Even if the guest speakers are given the spotlight as experts, everybody in the café has the same right to speak.

Small and Lively, Ergo Successful

"Great training in participatory discussion", wrote one audience member in his Facebook profile after a EURAC science café about the connection between democracy and the Internet.

More than the quantity of the audience, a key criterion to evaluate the success of a science café is the intensity of the debate. Exchanging opinions and asking questions with people on different topics is a good exercise for a local community.

Another advantage worth mentioning is the fact that small events are often seen as less influential on public opinion than larger information campaign or events. That's why science cafés rarely suffer from external political and/or economic pressure. At the same time, they serve as an attention multiplier. Spreading from the bottom up, the vines of scientific culture weave the public debate through friends, social network users, radio audiences, and so on.

In particular, science cafés represent a propitious stage for open discussion about current burning topics.

Science cafés can be used as a tool for civil society: they build awareness of the connections between science and society and of its role in decision-making processes.

The Science Café Czech Republic promotes a wide range of scientific discussion, but applies a strict rule: no religion and no politics. In contrast to this, EURAC Science Café is open to all current event topics, providing a scientific background to the discussion. For example, a café was held about a proposed Italian law on artificial insemination, and a few cafés were devoted the comparisons between the Islamic and Christian religions in different themes (medical care, the role of women, political participation). In these cases, good facilitation is essential.

Let's Talk Money

Science cafés are a cheap solution when compared to other science events such as festivals or exhibitions.

A private group with few sponsors (small grants awarded by municipal authorities or private sponsors), such as is the case of Science Café Czech Republic, can produce its science café events through a non-profit organization organized and run mainly by volunteers.

A public relations department of a research institution, such as the European Academy, can reach wide visibility with limited investment.

Science cafés usually adopt an honorarium-free principle. Generally, scientists are pleased to present to their projects to the public, and don't ask for money. By selecting guests locally (for example, the local university, hospital or private research centre), travel expenses are reduced.

The EURAC science café offers a (very) small fee solely to professional facilitators and scientists coming from distant universities.

Promotion via the Internet works very well and is not that expensive; leaflets and other printed material can be done in-house and be very simple. A private sponsor can finance the printing. The venue can be "borrowed" free of charge.

Starting with a basic investment of hundred Euros per evening, including drinks and travel and administrative expenses, costs can rise according to the capacity of the organization. If the organizers manage to find wealthy sponsors, or if the management recognizes in the science cafés a fruitful PR vehicle, the organizers can invest in external experts and attractions such as a DJ or band playing after the official end of the session.

Network

In the Czech Republic as in Italy the number of the science cafés is currently on the rise. In both countries there's a network connecting them all, even if they are very different in nature.

In the Czech Republic the science cafés appeared in 2008 in Prague, and since then the Civic Association Otevirame that launched them has promoted other meetings in different cities under the same umbrella. The non-profit association issued a handbook for new organizers and provides start-up support to new science cafés.

In Italy, the first science cafés started few years before, in the late nineties (the first science cafés started in Florence). Since then the network has been informal: information exchanges via newsletters and a website. In the summer of 2010, the coordination group has been considering whether a separate entity such as an association should be founded.

Conclusion

'One swallow does not a summer make', observed Aristotle in the 4th century BCE. Similarly, a science café cannot be the only player in the field of the public communication of science and technology. Nonetheless, an extensive network of science cafés could significantly contribute to shape the scientific culture of a society from the bottom up, as well as to facilitate the exercise of participatory democracy. This communication format truly promotes the unfiltered exchange between experts and non-experts.

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6.

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Public Understanding of Renewable Energy PURE

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Abstract. Public understanding of science PUS is a central concept among science communicators. Public understanding of renewable energy PURE is proposed as an important sub-concept of PUS. The aim of our paper is to interest and invite science communication scientists to join a PURE research project. Four separate important questions for a PURE research project can be identified: (A) Is PURE important? (B) Which issues of PURE are the most important ones, according to renewable energy scientists? (C) What understanding of renewable energy has the general public today, worldwide? (D) How to achieve PURE?

Keywords: Public understanding of science, PURE, PUS, Renewable energy, science communication, science centre.

Introduction and Definitions

Public understanding of science is today an established concept. There is even since 1992 a scientific journal with this name. The concept is usually referred to as *PUS*. Bauer (2009) has given a 3-fold definition of PUS: (1) "Debunking of superstitions, half-knowledge, complete and utter ignorance, misunderstanding and mumbo-jumbo, and virulent memes that give rise to anti-science." (2) PUS is to "improve science literacy, to mobilize favorable attitudes in support of science and new technology, to increase interest in science among young people and other segments of society, and to intensify public's engagement with science in general and for the greater good of society." (3) "PUS considers common sense as an asset" and PUS research should "chart out the public controversies arising from new developments and in different regions of the world" exemplified by "the impact of the climate of opinion on knowledge production."

During the planning of Sweden's first science centre The Futures' Museum, one of the authors (Broman) gave seven reasons for creating a science centre (Broman 1984, slightly revised 2004b): (1) Give an insight that science is understandable. (2) Awaken curiosity. (3) Give people the courage to experiment. (4) Facilitate public understanding of science. (5) Provide preparedness to withstand superstition and pseudoscience. (6)Amuse and entertain. (7) Provide aesthetic experiences. The reasons have been described in some detail in English elsewhere (Broman 2005). Reason (4) is in line with Bauer's definitions (2) and (3), and reason (5) coincides with Bauer's definition (1).

Underlying the statements is the notion that PUS is important, which scientists happily believe, and we of course agree, but it is not as simple as that. There are e.g. so many different sciences (which in turn are divided into many disciplines). A rather popular notion is that "science" is that same as "natural sciences", but that is not the case. Again citing Bauer, science also "includes engineering and medicine, the social sciences and humanities, old and new disciplines with clear boundaries, but also ... fuzzy transdisciplinary techno-sciences." But maybe all different disciplines are not equally important that the public understands?

It is also vital to identify target groups, since some may be more important than other. Loosely defined target groups frequently mentioned are young people (in the world of science centres often restricted to the "7-eleven group" of elementary school children), voting adults, and decision makers. Other interesting group may include teenagers, refugees, religious fundamentalists, senior citizens, people living in villages as well as cities, just to name a few.

It is also important to identify groups of science communicators. As an example, The European Science Communication Network ESCOnet, 2005-8 developed and conducted a series of workshops on science communication training aimed at young post-doc researchers (Miller *et al.* 2009).

Since renewable energy is our main interest, the authors have decided to investigate a sub-set of PUS, namely public understanding of renewable energy PURE. The remainder of this article attempts to give a starting point of a potential research project on PURE. The main questions are "is PURE important?" and, if the answer is *yes*, "how could PURE be achieved, and which meansof achieving PURE are potentially useful?"

On the Importance of Public Understanding of Renewable Energy

There are several reasons why public understanding of renewable energy might be important. Four of them are these:

(1) The earth is a lonely planet in a vast space, not as crowded as the impression one gets from science fiction movies. For humans to move from a destroyed earth to another hospitable planet is just impossible.

(2) The earth is a planet alive with a dead sister and a dead brother. Venus is too hot for life due (also) to too much greenhouse gas, while Mars is too cold due (also) to too little greenhouse gas.

(3) Anthropogenic influence on the world's climate, in particular climate warming due to release of greenhouse gasses like carbon dioxide CO_2 and methane CH_4 is generally agreed upon among (IPCC 2007).

(4) One major source of greenhouse gases is combustion of fossil fuels, which has to be replaced by increased energy efficiency and large-scale worldwide dissemination of appropriate technologies for harnessing renewable sources of energy.

A reasonable conclusion is that public understanding of renewable energy is important. An important task of a research project on PURE would be to identify pros and cons in this respect. There are also several attendant questions: What do professionals - researchers, planetarians, teachers - say? How interested is the public–and different target groups–in renewable energy, and what do they already know? Which disciplines in renewable energy science are more important than others? A very crucial role exists of common people in the success of this objective of large scale harnessing of renewable sources of energy, since as adoption as well as design, developing, manufacturing etc, would require their participation.

How Could Public Understanding of Renewable Energy be Achieved, and which Means Are Potentially Useful?

There are of course several different channels that can be and are used in conveying attitudes towards and knowledge of renewable energy subjects: Newspapers, TV programs, books, interactive exhibits in science centres, lessons in the school. Different media certainly attract different target groups. One of the tasks for the project to find out is of course how science centres with interactive exhibits can be used for the envisaged purpose i.e. PURE. It is even not possible to judge all centres the same - it is of course a great difference between large science centers (like Nehru Science Centre in Bombay, Cité de Science and Technologie in Paris or Exploratorium in San Francisco) and small ones (like Ekohuset in Strömstad and Molekylverkstan in Stenungsund; both Sweden).

As has been shown by several authors, among them Franck Pettersen in a master thesis (Pettersen, 1995), is that a combination of watching a planetarium show and doing experiments related to the show is very useful. (Planetariums used to be devoted basically to astronomy using a classical opto-mechanical star projector. Increasingly, planetariums today concentrate on edutainment shows with astronomic content, using all-dome video technique. Shows related to climate change and its solutions would be easily produced using modern planetarium projectors and would fit nicely under the planetarium dome.) Here are two other voices on interactivity:

Michael Spock, former Director of *Boston Children*'s *Museum*, borrowed the Chinese philosopher Confucius' proverb as a motto for the museum: I hear and I forget, I see and I remember, I do and I understand (cited in Ott 2001).

William Glasser wrote (1990): We learn 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we both see and hear, 70% of what is discussed with others, 80% of what we experience, and 95% of what we teach.

An important component of achieving PURE is likely to be interactivity and hands-on experience, and useful environments for this are science centres. Some examples of this are shown elsewhere (Broman 2004a) in photographs from the Teknoland outdoor science centre 2000-2001: Yourself a Sundial, Toddlers' Teknoland, Solar Energy Surfaces, The Greenhouse, and The Solar Heated Chess Board.

Popular education of renewable energy through IASEE and ISREE

International Association of Solar Energy Education IASEE started in December 1989. In September 1990, IASEE became the International Solar Energy Society ISES Working Group on education (see e.g. Blum *et al.* 1994). Also since 1991, IASEE has arranged a series of symposiums, International Symposium on Renewable Energy Education ISREE, held every or every second year, sometimes as part of the biennial ISES Solar World Congress. At each symposium, between 10 and 30 papers were presented. Most papers have dealt with education in schools and at university level, and certainly school children and university students are important target groups, but here we will concentrate ourselves on the general public.

One of the 1991 ISREE papers presented was *On the Need for Solar Energy Education* (Broman and Ott 1992). In this paper, elementary and secondary school education, vocational training, university courses, educating decision makers, and educating the general public are treated. An excerpt from the paper reads (slightly edited):

Educating the general public

Ordinary people are the ultimate utilizers of energy from the sun and accordingly need basic knowledge in how to make use of this new technology and be motivated to use it. A number of ways to educate large populations are readily available. Some proven examples:

Mass media. This includes newspapers, weekly magazines, radio, and TV. You address professional journalists, and if you manage to teach them some basic facts, they will frequently make o good job in popularizing what they have learned.

Exhibitions. We have built both Science Centre exhibitions (1986 and 1990 on solar measurements for the Futures' Museum in Borlänge, Sweden) and travelling exhibitions (Alternative Energy 1976, Solar Energy Exhibition 1989; Broman and Gustafsson 1991). The educational value of an exhibition is greatly improved if it provides hands-on experiences.

Another kind of exhibition is the trade fair with commercial and institutional exhibitors. Such fairs can range in size from the one hundred sqm or so of exhibitions that accompany SERC's Solar Energy Days to the multi-acre exhibition of the UN Conference on New and Renewable Energy Sources of Energy in Nairobi 1981. Such fairs contain up-to-date technological information for many categories of visitors and should be made available both to professionals and to the general public.

Lectures, etc. General admission popular lectures sometimes attract good-size crowds, especially if arranged as debates or panel discussions, or if a well-known speaker is featured. Lectures can also be video-taped, and can, with appropriate solar powered equipment, be shown just about anywhere (Arafa 1992).

Community college courses. These are excellent in giving interested individuals more-than-basic knowledge. The aim of such courses can even be that every participant builds his own solar collector (see Börjesson *et al*. 1994).

Another paper at ISREE'91 dealt with renewable energy education and training in an Egyptian village with a programme consisting of public presentations, group discussions, simple solar kits, children competitions, technical training workshops, exhibits with working models, working systems, video-training systems, and a communal library (Arafa 1992).

A regional training workshop was held in Libya in December 1990 with the objective of familiarizing women in developing countries with renewable energy development and technology; the workshop was presented at ISREE'92 (Bara and Muntasser 1993).

A community college type of educating people that is popular in Sweden is called study circles. A typical study circle consists of a circle leader - the teacher - and 5-10 participants. Especially during the 1990ies, knowledge about solar heating was spread in many locations in Sweden in this form, where each study group built a solar heating system at one of the participants' house, using a popular build-yourself solar collector kit; this was presented at ISREE'93 (Börjesson et al. 1994). A thorough investigation of this kind of education is a case study done by by Henning (2000).

The importance of public understanding of renewable energy was dealt with at ISREE'02 (Broman 2002). In this paper, a result from SAS (Sjøberg 2000) was cited:

The study *Science and Scientists* (SAS) asked ten thousand (10 000) 13-year old pupils in 21 countries:

"What do you want to learn about?"

"New sources of energy - sun, wind" was among the 25% least popular answers, and it was much less popular among girls than among boys.

* Why is it so?

* Should we do something about it?
* If so, how?

<u>* Why is it so?</u>

Pupils - and adults - are interested in scientific and technological subjects for a number of reasons:

* Economical reasons
* Usefulness
* Interesting, fun
* Relevant

Renewable energy obviously does not meet these requirements! At ISREE'02, the rhetorical question "Should we do something about it?" was answered with a "Yes!", followed by

"If so, how?" and a try to answer:

- Visibility of renewable energy is important
- The school is important
- Media are important
- Exhibitions, Science Centres and Science Parks could be used to meet people of all ages."

Experiences from using science centre exhibits in educating the general public on renewable energy were presented at ISREE'03 (Broman, 2004a).

Renewable energy dissemination at village level

A large proportion of the Earth's population is rural, and their quality of life could be improved at the same time as their impact affection on climate is decreased by introduction of renewable energy utilization at village level: "Low carbon technology for low-purchasing power people." This includes a multitude of technologies and education of users is therefore critically important. A good example is dissemination of family size biogas plants in India - to date 4 million units and the aim to increase the number of plants to 12 million.

Another example: Electricity for light has quickly become affordable by the development of low-cost white high-intensity low-energy light emitting diodes (LED). Mobile phones are spreading rapidly also among rural people in developing countries, and these are effectively charged using the same small not-so-expensive photovoltaic (PV) modules used for powering LED lamps.

When educating rural people, it should be understood that many people live below the poverty line and that illiteracy is common. It is not always easy as the following example may illustrate (Sakr 1984). Egyptian authorities wanted in the early 1980ies to implement solar collectors for water heating in a rural area. The farmers however refused to use them for from their point of view good reasons. In an earlier campaign in the same area, authorities had tried to introduce family planning, and the local people suspected that this new technology was just another attempt to decrease their fertility.

A Public Understanding of Renewable Energy Research Project Proposal

As obvious from the preceding chapters, we have for several years been interested in public understanding of renewable energy. We believe however that presently this concept is more important than ever. An interdisciplinary and international science communication project on PURE is proposed with the hub at Strömstad Academy (www.stromstadakademi.se) in Sweden. It should include both research on the importance of PURE and on the impact of different methods to achieve PURE including determining which methods are best adapted for different target groups.

This means that different target groups have to be approached from renewable energy specialists and energy policy makers to school teachers (Kandpal and Mathur 1982), engineering students (Garg and Kandpal 1996) and different kinds of end-users. A variety of methods, such as questionnaire studies, interviews and focus groups, should be considered.

We have made a start by supervising Science Communication master students and teacher students at Dalarna University during the last decade. A few of them have written their theses on the impact of experimenting with renewable energy at science centres on school pupils in ages 6 to 18. One example is the thesis of Harahsheh (2007), indicating a measurable impact on 15-yr. old pupils on their attitude towards renewable energy.

There is however much more that need to be done. A possible start could be a questionnaire distributed world-wide to a well-defined target group (such as visitors to science centres) aiming at finding out the present level of public understanding renewable energy.

Please contact us if you would like to participate in the PURE project. The authors' email addresses are found at the top of the article.

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The Role of Chinese Scientists in Science Communication

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Abstract. By the end of 19th century, the word and concept of science was transplanted into China from Japan. Chinese people accepted the concept of science as the studies of each fields such as physics, chemistry or biology. At the beginning of 20th century, some Chinese students got the funds of boxer indemnity to study in America, especially those who studied in Conwell University became aware of the true concept of Science that Science was only refer to each field of research but also or more important, the system of exploration of the nature with observation, hypotheses, experiment, open to colleagues for study with the data and conditions that the results were made. And more important, science was a methodology of universal study of the nature and society, etc. They organized Science Society of China and started publishing a magazine “Ke Xue” (“Science”) in Chinese in 1915 with the objective that trying to introduce the whole concept of Science to Chinese in China.

After the founding of new China in 1949, all the organizations of scientists were mainstreamed into Chinese Union of Natural Scientists and Chinese Union of Popularization of Natural Sciences. They learned the experiences of science popularization activities in Soviet Union in 1950s when Sino-Soviet was in good relations. Mr. Hua Luo-geng was one of them who communicating basic mathematics as optimization to the industrial workers that could be used in practice. He did not stop popularizing the mathematic methods even during the Cultural Revolution.

In the editorial of People’s Daily in 1994 and the Law of Science Popularization in 2002 the government encouraged the scientists to communicate science to the public to combat the superstition and pseudo-science. Chinese Academy of Sciences the top institution of science researches was encouraged to going out to do science communication.

The development of science and technology is getting fast in recent years in China but more and more controversial issues and events that coursed the public skeptical towards science such as the approval of Genetically Modified Rice planting in large fields and the chemical plants that were being tried to built at the area that thought threatened the citizens lives and the environment. The scientists played different roles in these events. I will talk about the roles they are playing during the discussion and events and the data we got from surveys of Chinese scientists towards science communication.

Social Agency, Justice and Transformation in the Quest For a Globally Representative Communication of Science

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Abstract. The communication methods and educational systems that are applied to report scientific findings and technological advances to the public have come under repeated critical scrutiny during the past few years. This communication process, often overlooks deep seated philosophical and epistemological differences between cultures and continents. One prominent area of neglect is the failure to incorporate the specific knowledge(s) of traditional communities into mainstream epistemological discourse. Traditional knowledge has historically been restricted as 'discoveries' by outsider researchers. The traditional epistemic status of traditional communities, as a direct result, remains to be considered as incompatible with the 'scientific' and 'progressive' nature of modern western knowledge. Modern science and technology, therefore, is deemed to operate above (and beyond) the more 'primitive' processes of traditional scientific methods. Modern science is only prepared to acknowledge the 'primitive' methods of traditional knowledge systems in so far as the latter serves as confirmation of the formers' alleged superior cognitive status. It is from this so-called superior perspective that modernity will allow itself to speak of 'traditional agricultural methods', 'traditional water harvesting methods' or even 'traditional craft production methods'.

In this paper I will argue against this artificial barrier in the communication of science. Considering science principles as universal, and acknowledging the historical role that philosophers play in contextualising science knowledge, I will present some options to guide the re-alignment of global science communication towards becoming a more inclusive activity between the industrialised and developing worlds by asking fundamental philosophical questions about social justice, agency and the possibility of change. My focus will be on Africa and India. I will mention, in specific, the work of western philosophers such as Jürgen Habermas (1981. 1987, 1994) and Richard Rorty (1980) and African Philosophers such as Paulin Hountondji (1997, 2002) and Kwasi Wiredu (1975, 2000). Their opinions will be juxtaposed against ideas that developed in India as explored by Amarthya Sen (2000).

Keywords: western science, traditional science, epistemology and philosophy.

Introduction

In the wake of a near absence in communicating science to the public in Africa, the discipline of African philosophy took as task the topic of science communication to explore the philosophical relation with science in general and with traditional societies in specific. The development of African philosophy, as a result, is closely associated with the advancement of science and technology. This relationship is not unique. It is similar to the development of European philosophy when philosophy-as-epistemology affiliated strongly with the Enlightenment 'idea of progress'.

During the European Enlightenment science became the 'subject' and scientific method was recognised as the measure for progress. This centrality of philosophy-as-epistemology in the 'project of modernity' and its inability to overcome the reliance on a subject-centred epistemological paradigm, is intensely debated by western philosophers such as Jürgen Habermas (1981; 1987; 1994). Habermas initially strived to reconstruct the genealogy of the modern natural and human sciences by inquiring about the details of their social, historical and epistemological conditions of emergence. He later adopted a perspective based on a theory of 'communicative action' derived from speech-act philosophy, socio-linguistics and ideas about conversational implicature (Honderich, 1995:330). Central to the work of Habermas is, however, the effort to combine specialist philosophical interests with an active commitment to promoting informed discussion on issues of urgent public concern (Honderich, 1995:330). Habermas (1981), in this regard, is a promoter of effective science communication.

The modern-day 'lack of independence' of philosophy (from science progress) has also been dramatically challenged by western philosophers such as Richard Rorty (1980. 1982). Central to Rorty's (1980) challenge is the deconstruction of the ontological assumption of (western) man as the privileged seat and centre of human rationality. The notion that epistemology can exist as a discipline capable of justifying and validating scientific knowledge claims, is rejected by Rorty (1980). It follows that philosophy is incapable of providing a neutral universal framework that can be assumed (adopted) to precede, justify and validate the foundational scientific form of knowledge. A significant consequence of Rorty's rejection of this epistemological foundationalism is his rejection of a correspondence theory of truth, deemed capable of describing reality 'as it is'. In the place of an objectivist approach to reality as a project of epistemology in the service of science, Rorty (1980:315) encourages his reader to accept the possibility of an *epistemological vacuum* that naturally follows the demise of the modern epistemological tradition.

Rorty's (1980) arguments against epistemological foundationalism are important in so far as it encourages a re-conceptualization of modernity's central universalistic claims with regard to truth, objectivity and rationality. For as long as nature (the universe) is assumed to be absolutely (ontologically) of humankind, the scientific enterprise will likewise be conceptualized as a discipline that transcends the more parochial interests and passions of the non-scientific thinker.

The importance of this argument for us is Rorty's (1991:166) promotion of a ruthless scepticism about philosophy's self-definition and epistemological 'task' in the defining of science. He criticizes the limitations of philosophy-as-epistemology to recognise appropriate scientific (including traditional) knowledge since science in its current form provides humanity with a basic 'ticking list' of observations which too often lacks deeper probing and rules out further reflection. Sandra Harding (1997:49) maintains that 'modern science' re-inscribes the dichotomy between the dynamic, progressive sciences of the west and the static unchanging traditional knowledge of other cultures. According to Harding (1997) this condition generates the benefits of modern science to be disproportionably distributed to western elites and she claims that: "… whether sciences intended to improve the military, agriculture, manufacturing, health or even the environment, the expanded opportunities that science makes possible have been distributed predominantly to already privileged people of European descent, at the cost to the already poorest, racial and ethnic minorities, women and Third World peoples" (Harding, 1997:55).

According to Rorty (1980), philosophy should abandon efforts to consider reality through some *a priori* conceptual framework (which we ourselves have put into existence). In addition, philosophy should abandon efforts to claim a universal context for the validation claim of scientific knowledge. Such a post-epistemological approach will render the need for a transcendental foundational discipline obsolete. The real work of science must be done by the scientists, and the philosopher must resist the temptation "… to jack up [the achievements of science] a few levels of abstraction, invent a metaphysical or epistemological or semantic vocabulary into which to translate it, and announce that he has grounded it" (Rorty, 1991:168).

In the place of the modern epistemological legacy of foundationalism, Rorty (1980:315) proposes a hermeneutic approach to rationality and truth in the objective world. According to Honderich (1995:353), hermeneutics refer to "… the inherent circularity of all understanding, or the fact that comprehension can only come about through a tacit foreknowledge that alerts us to salient features of the text which would otherwise escape notice". Bernstein (1983:38) points out that, according to the interpretation of texts, the earlier traditions of hermeneutics distinguished three elements:"… *subtilitas intelligendi* (understanding), *subtilitas explicandi* (interpretation) and *subtilitas applicandi* (application)". Heidegger (1977) and Gadamer (1975) extended the application of hermeneutics, initially focussed on the interpretation of text, to the interpretation of technology. Gadamer (1975), for example, proposes that the three features of hermeneutics–understanding, interpretation and application–do not happen successively and functions collaboratively. He focuses on the relation between 'practical knowledge' and 'theoretical/technical knowledge' and considers hermeneutics to be the heir of practical philosophy which, in turn, bring concepts such as 'scientific method' (in the sciences) and historico-critical method (in the human sciences) into question (Gadamer, 1975:342).

According to Rorty, hermeneutics relieves us of the need to justify scientific knowledge claims from a universal perspective. He argues furthermore that the hermeneutic principle of justification of our social principles is sufficient ground for our acceptance of the notion of truth in a pragmatic sense. For Rorty the hermeneutic approach therefore cynically presents "… an expression of hope that the cultural space left by the demise of epistemology will not be filled" (Rorty, 1980:315).

Rorty's (1980) critique of the modern epistemological condition and his philosophical announcement of a post-modern ethos characterized by contingency and pluralism, (in short, an ethos epistemologically devoid of all claims and pretensions to universalism) opens up the possibility and the need to explore other non-western forms of knowledge and rationality. By accepting the ethno-cultural horizons governing one's place in history as the point of departure, Rorty (1980) therefore encourages a more conversational approach to the question of knowledge "… with the notion of truth being associated with the best idea we currently have to explain what is going on" (Rorty 1980:320).

African philosophy in service of science

With the European enlightenment promoting scientific innovations, the 'idea of progress', it was argued, became the measure of modernism in the west. On the other hand, 'colonialism' became the African measure and indicator of scientific progress. It can be argued that colonialisation in Africa marginalised traditional scientific knowledge and traditional practices as rapidly as modern industrial and economic development expanded in the west. Underpinning the idea that all men are the same, the awareness grew that cultures differ and live in different geographical worlds requiring different social strategies for survival. For western science, in the quest to study man, 'race' soon became the marker for different social practices that constitute different cultures. Race therefore became a science 'subject' and racial differences became a cultural 'marker'. The paradoxical result of celebrating differences, respect for pluralism and acknowledgment of identity politics – which became the feature of a liberal-modern democratic outlook – made science a political issue since the science of human differences could only be read in a racial fashion (Malik, 2008).This can be referred to as the 'guilt of science'.

Opinions about the intensity of this marginalisation process vary. Kwasi Wiredu (2000:175), for example, does not consider modernism to be "… bad in and of itself, but [consists of] ill-conceived programs of implementing modernization [that] have been harmful to African societies". Wiredu (1975:320), in addition, implores us to distinguish, in the African context, between traditional – that is pre-scientific spiritualistic thought – and modern scientific theory.

If we consider that epistemology functions in the total context of the human 'right to life' in traditional societies, we need to recognise the universality of these actions. Wiredu (1975), in a sense, blames the west for looking at traditional African epistemology in a highly selectively manner, thereby overlooking the very specific, non-scientific characteristics that typify African traditional thought in general. The west tends to define this specific non-scientific characteristic as a way of thought to be peculiarly African, instead of looking at it in a broader context and acknowledging its striking similarities to western epistemology.

Kwame Gyekye (1997) is less critical about the west's duplicity in the even distribution of modern science and advocates acceptance of western modernity by Africa. According to Gyekye (1997:30), 'modernity' is to be considered an ideal measure of progress. 'Traditional' should be seen as something that should aspire to this ideal of progress by embracing the theoretical development of science that requires sustained scientific probing since "… the impulse for sustained scientific or intellectual probing does not appear to have been nurtured and promoted by our traditional cultures". The African philosopher Kwame Appiah (1992), in contribution to this debate, initiated intense and widespread discussions in Africa on the relationship between race and culture and the differences between indigenous and global knowledge systems. He became overtly concerned with efforts to define the course and causes of development in relation to the growth of science.

Emmanuel Eze (1997:12), who persuasively postulated that the philosophical notion of 'reason' was popularised at the beginning of modern (western) philosophy by

Descartes, furthers the argument around indigenous and global knowledge systems by claiming that "… the nature of human rationality seems to require that the best way to define reason philosophically is by demonstration. The demonstration will require amassing empirical or scientific evidence for the rational, and reflecting on this concept of evidentiality". Eze (1997) considers duplicity to be at the heart of modernity whereby modernity, in its subscription to ideals of humanity and democracy, condones the colonial subjugation and marginalization of non-western people by indicating the perceived difference between the rhetoric of the west and the 'lived reality' in Africa.

Based on the contributions by African philosophers, the relationship between philosophy and the sciences is quite pronounced in Africa. Paulin Hountondji (1976:99) in this regard proposes the hypothesis that "… the first precondition for a history of philosophy, the first precondition for philosophy as history, is therefore the existence of a scientific practice, the existence of science as organised material practice reflected in discourse. But one must go back even further: the chief requirement of science itself is writing. It is difficult to imagine a scientific civilisation that is not a civilization based on writing, difficult to imagine a scientific tradition in society in which knowledge can be transmitted orally. Therefore African civilizations could not give birth to any *science*, in the strictest sense of the word, until they had undergone the profound transformation through which we see them going today, that transformation which is gradually changing them, from within, into literate civilizations".

Ivan Karp (2000:4) appropriately observes that it is clear that African philosophers are divided into two camps; those who believe that technical and academic philosophy provides the tools for a much needed critique and revision of traditional African thought and those who argue that the critical skills and attitudes of western philosophers can also be found in African cultures. However, both these positions have roots in academic and social movements originating from the west. What is lacking is the centralisation of this debate within a non-western context.

Moving Towards Individual Agency, Abstract Theory and Openness–Examples From India

African philosophers realised that they are not alone in feeling marginalized from mainstream science and from being considered within the proviso of being 'underdeveloped' and 'unscientific'. Parallel problems are identified by, for example, the Subaltern group in India whose members argue that the specificity of the subaltern voice (by implication their epistemological contribution) has been systematically erased by both colonial and nationalist historians. The term 'subaltern' is used to group together the section of society who faces oppression (Morton, 2003). The Italian Marxist, Antonio Gramsci (1881–1937), used 'subaltern' to refer to a person or group of inferior rank or status caused by race, class, gender, sexual orientation, ethnicity or religion. He considered subaltern groups to be, by definition, subjected to the authority of ruling groups even when they rose up in rebellion. His definition of the subaltern was adopted by Gayatri Spivak (1998; 1988) and others because it easily provides a key theoretical resource for understanding the condition of the poor, the lower class and peasantry in India. The parallels drawn by Gramsci between the division of labour in Mussolini's Italy and the colonial division of labour in India, made this possible.

In both India and Africa there is a drive for recognition and respect for the complexities of the motives and cultures of these subaltern agents. This includes, as Karp (2000:3) suggests, respect for "… the complicit role of the intellectual in the power politics and crises of the postcolonial state; the role of criticism in the politics of knowledge; and the conflicts among cosmopolitan, nationalist and indigenous forms of knowledge. Intellectual historians and sociologists of knowledge will have to work out the reasons why parallel critiques have developed in such different disciplinary locations and discursive spaces in Africa and India, and they will also have to work out the differences as well as similarities in the ways in which postcolonial criticism emerges as a formation in two such different geographical and cultural locations".

In India, Amartya Sen (2000) aptly considered these issues mentioned above and, in addition, emphasised the role women can play in bringing about social change through agency and as free agents of change. Sen (2000) discussed in some detail the approach to gender differentiation from studies conducted by Jean Drèze and Mamta Murthi in India in 1999. When considering the high rate of female and child mortality in male dominant societies, causal relations to development were probed in variables, positioning low survival prospects against areas of possible agency: female literacy rates, female labour force participation, incidence of poverty, levels of income, extent of urbanisation, availability of medical facilities and the proportion of socially underprivileged groups (caste) (Sen, 2000).

Two aspects regarding the promotion of literacy in India became clear in the surveys conducted by Drèze and Murthi (1999). In the first place gainful employment produced ambiguous outcomes: responsibilities for household work became an added burden. In the second place, becoming more literate statistically showed a significant reduction of under-five mortality. Finally "… the impact of greater empowerment and agency role of women is not reduced in effectiveness by problems arising from inflexible male participation in child care and household work' (Sen, 2000:197).

Dual Worlds, Multiple Problems–Solutions Through Agency

By looking at hermeneutics, as proposed by Rorty (1980), we are provided with an option to experience some measure of relief from a need to justify scientific knowledge claims from a universal perspective. When we apply the Rortian hermeneutic principle as aid in the justification of our social principles, we might find sufficient ground for change. What these changes should aim to be, however, is difficult to establish. If we liberate the debate from the social movement of post-colonialism we create a 'freezone' where new perspectives on developmental issues can become intertwined with debates on 'scientific validity' and 'scientific literacy' – both prominent issues in science communication debates and the research focussed on by the Public Understanding of Science (PUS). This, however, is no easy task and comes with its own particular and spectacular problems. Aijaz Ahmad (1992:315), for instance, persuasively speculates about a world devoid of differentiated structures and the disappearance of the so-called 'three worlds'. In the problematic issue of merging the world economies, he mentions the subordinated partnership of developing countries with imperial capital as a debilitating factor. He proposes that "… most of the Asian zones simply cannot ever hope to develop stable societies, and the devastating combination of the most modern technology and backward capitalist development is likely to inflict upon these societies, on lands and peoples alike, kinds of degrees of destruction unimaginable even during the colonial period".

The most appropriate option I can think of is to turn–yet again–to the philosophers for redemption. How will they advise science communicators to effectively promote science communication against such a diverse and complex background? Three scenarios are possible:

1. *The redemption of traditional knowledge systems (IKS).* It is now acknowledged that some aspects of African thought are collective and unchanging. To emancipate IKS both Wiredu (1980) and Hountondji (1983) valorise the individual as the agent of change through social and cultural criticism. Both use the colonial and postcolonial as spatial and temporal realities and both require the application of individual agency, abstract theory and openness. More specifically, Wiredu (1980) proposes analytical practice in the quest to solve failed past methods and solutions. Hountondji (1983) proposes the Althusserian neo-Marxist notions with its specifying evolving relationships among power, ideology and a constantly changing social world (Karp, 2000:8).
2. *Emancipatory social justice through agency.* Agency refers to a person being the 'subject of action', who posses the capacity to choose between options and then, ultimately, to be able to do what one chooses. Agency is treated as a causal power (Honderich, 1995:18). In patriarchal societies such as Africa and India, social justice involves more than 'being free to choose'. Social justice means active participation in education. In this regard Marion Young (1990:173) states that: "… a goal of social justice, I will assume, is social equality. Equality refers not primarily to the distribution of social goods, though distributions are certainly entailed by social equality. It refers primarily to the full participation and inclusion of everyone in society's major institutions, and the socially supported substantive opportunity for all to develop and exercise their capacities and realise their choices". Chandra Mohanty (2003:205) adds to this by stating: "Pedagogy needs to be revolutionary to combat business as usual in educational institutions … revolutionary pedagogy needs to lead to a consciousness of injustice".
3. *Critically analyse aspects of modernity and tradition in order to promote individual and social agency in the developing worlds.* Challenging the concept of western modernism is

inevitably linked with the embracement of western capitalism and western scientific rationality. Africa embraced western capitalism but scientific rationality became an ambivalent site of dispute through the polarisation of tradition and modernity. One of the prominent philosophers who challenge Africa to become independent (and literate) in order to participate in the global science debate is Hountondji (2002) who critically recalls comments on the history of integration and subordination of African traditional knowledge to the world system of knowledge. Hountondji, (2002: 501) identifies a number of what he calls 'scientific extroversions' (Africa being forced to integrate into the world market of concepts) which indicates that "… a need to secure an audience or readership, a legitimate need, often leads Southern scholars to a type of mental extroversion. They are pre-orientated in choosing their research topics and methods by the expectations of their potential public which then causes them to lock themselves up into an empirical description of the most peculiar features of their societies, without any consistent effort to interpret, elaborate on, or theorize about these features. In so doing, they implicitly agree to act as informants, though learned informants, for western science and scientists" (Hountondji, 2002: 503).

Conclusion

The list of actions that are required towards achieving social justice in the developing worlds is much more comprehensive and much more complex than the few points I was able to highlight during this presentation. I also hope to further the debate on the complex issues related to the main objective of this conference from a developing world context. As indicated by the organisers of this conference, the economic and social wellbeing of society promotes participatory democracy and implies the ability to respond to technical issues and problems that pervade our daily lives. This, by implication, requires a serious deliberation about the status and relation between modernity and tradition. The perceived gap between modernity and tradition, in facilitation of a better science communication, can only be addressed by a thorough understanding of social justice, the promotion of agency on all levels and collectively amongst all members of society, creating a deliberate possibility of change.

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Analysis of Doctoral Research in Science Communication

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Abstract. In this paper we will present a review of over 57 PhD theses on science communication, from 2000-2010, coming from all over the world. From this analysis we reflect on the development of science communication as a scientific domain. The review shows that media relations with science and the means of science communication are the most researched topics. More fundamental theoretical studies or reflections on science communication are much less to be found among PhD-theses. In this paper we discuss this ‘rhetorical opportunity’ for reflective science communication and we discuss how PhD research might contribute to deeper theoretical development of science communication.

Keywords: Theoretical development, PhD research review, Rhetorical opportunity, Reflective discipline, Science communication graduate school

Introduction

PhD research is normally recognized as the cutting edge research in a domain. So an overview of theses in a domain might say something about the state of the art in a field from a theoretical perspective. This perspective is important to know since a core of a field describes its rhetorical opportunity (Seydel, 2007): what are the intellectual sources? What is the academic tradition in which the research is carried out? What has science communication to tell based on these sources and traditions to socio-cultural problems.

This question does not stand alone. In the September 2010 issue of the *Journal of Science Communication* established researchers in the field were asked to reflect on the status of science communication from the point of view of a discipline and a field of study. Pitrelli (2010) asked: What topics should science communication focus on and why? What is the real degree of autonomy from other disciplines? Bell(2010) admitted: *if I’m honest, I’m not entirely convinced science communication really exists*. But other authors pleaded for further theoretical development (Trench and Bucchi, 2010). They stated that the following conditions should be recognized to be a discipline: (1) a bounded field of study; (2) shared interests, terms and concepts; (3) significant presence in teaching and research in the higher education sector; (4) international research; (5) specialist scholarly publishing; (6) organized communities or networks of scholars; (7) a body of theoretical work that underpins empirical study. In their contribution to this special issue they concentrated on the first and the last point. They stated that science communication is a defined field of study and has grown over the last 20-30 years in the intersections between disciplines such as science education, social studies of science, mass communication and museology. It developed, as Trench and Bucchi describe, as a field of formal study only after it was a named practice with associated training and education programs. So science communication is a field based on various disciplines strongly attached to a practice. From our current analysis of a decade of science communication theses we may obtain insights which are helpful to the other issues raised by Trench and Bucchi as well.

Gascoigne et al (2010), also in this special issue, defined science communication as a field of study based on: 1) the presence of a community; 2) a history of inquiry; 3) a mode of inquiry; 4) the existence of a communications network. They concluded that the technical requirements for being able to claim that a field of research has achieved the status of a discipline, is not clear. Here too this theses review may fill some of the gap Gascoigne et al encounter?

The final contributor to the Journal of Science Communication discussion, Hornig Priest (2010), wonders what it entails to be an academic discipline. She writes that a academic discipline involves attempts to understand, influence, improve and critique the processes of science communication, including attempts to grasp their broader social, political and philosophical significance and dynamics, alongside their immediate impact on individuals and groups. Again, in the case of this paper it might be possible to obtain some of the answers to what Hornig Priest asks, e.g. do the theses critique the existing processes of science communication?

Moreover, Hornig Priest asks herself if there is a need to become a discipline. Some of the interdisciplinary disciplines still stay a subdiscipline. This might be the case for science communication as well. However, she believes that the unique interwoven contributions of subdisciplines are at the core of what gives science communication the potential to continue its emergence as a true interdisciplinary subdiscipline and not just a set of activities or practices or a list of interesting subjects.

From the sub-disciplines as Mulder et al (2009) state, science communication can be considered as an emergent domain, with its own specific multi-disciplinary dynamics. This is, as we will show in this paper, stated by the overall view obtained from a decade of science communication theses. And, as Hornig Priest says, in line with Trench and Bucchi, this is very important, since otherwise the science communication domain would risk being defined merely as the ‘outreach’ departments of the institutions that produce new knowledge. The latter is indeed happening with the vast European Union projects in which the science communication part is mostly ‘reduced’ to events and some kind of evaluation. Science communication should be part / integrated in the research process itself and should be researched as such (Van Der Sanden and Osseweijer, in press). PhD research should be the very cutting edge of developments in science communication. Is it possible to fill in or support all the above from a decade of theses? Is there an emergent field of science communication to be discovered? We also asked ourselves how science communication PhD research could be enhanced from an international perspective.

Collection of Data

We collected information on 57 theses world-wide and categorized these theses according to the criteria, *major research theme, research aim, research question, research subject, theories / theoretical framework used, mentioned practical implication* and *kind of research*. All respondents sent an abstract and 70% of them also sent a summary. In most cases we received full information in English but some of the theses are in other languages and we had only English translations of the abstracts. However, we believe that this collection of thesis information does give an adequate representation of the issues stated above. Of course, we keep in mind that reviewing the theses will generate a new set of criteria.

Results

In outline numbers we can describe our sample as follows:

Total is: 57

Countries: Ireland, UK, Australia and USA (34); Italy, Netherlands, Austria, Germany, Belgium and Spain (17); Korea, Brasil, Colombia and Japan (6).

Subject: science (19); medicine (15); environment (6); genetics (6) humanities (5); social studies of science like (6);

Research theme: media and journalism (14); means of communication (10); engagement and dialogue (7); scientists’ role and image (7); roles of stakeholders (6); evaluation (1); various (12).

Methodology: media-analysis, surveys, interviews and case studies are by far the most popular.

Research aims. It is not possible to identify unifying research aims. For example, in the media and journalism theses the stated research aims include:

- analysis of newspaper content and observations and in-depth interviews with Ontario journalists from a variety of print and broadcast media outlets, in rural suburban and urban areas;
- investigates the extent to which a particular group of the public (18-25 years), Northern Ireland, interact with science and the media and what effects it has on their actions, knowledge and understanding of science;
- examines how four contemporary British scientists and popular science writers are portrayed as mass media celebrities;
- examination of representation of science education in UK newspapers and focuses on the role of the expert sources in a controversy about the teaching of creationism alongside the theory of evolution in the science class rooms;

- examines factors shaping journalistic coverage of risk debate involving new technologies;
- explores the role of the press in the process of consolidating the genetic approach to human biology and disease in the Spanish context;
- analyze the relationship between obesity and poverty in Brazilian daily newspapers.

Theories used

Too many to mention here, but these include: health belief model; elaboration likelihood model; self categorization theory; Pierce’s semiotic logic; self-transcendence and self-enhancement; framing; theory of planned bevaviour; Philipsen’s speech codes theory.

Contribution to domain or practical field

These include:

- the evidence points to of the importance of understanding expertise not only in individual but also in collective terms. Overall, the thesis demonstrates a more complex conceptualization of expertise;
- the thesis argues that universities therefore need to take the responsibility for this in the same way as they are responsible for academic training and research;
- the results have implications for the way in which research institutes incorporate their accountability responsibilities into the organisation’s culture;
- the study shows the stability of the normative structure of science.

Conclusion

From the results above we may conclude that: (1) the Anglo-Saxon world is most active in research in this field; (2) hard sciences like medicine and natural science are the most researched subjects of science; (3) media and science journalism are well researched; (4) that there is no identifiable common core of knowledge within those themes or research; (5) there is no identifiable common aim in contributing to the domain or the practical field. It is also difficult to see evidence of the development of: (1) a recognizable theoretical framework; (2) a network or community of researchers; (3) a shared mode of inquiry, interests and concepts and practices.

So from the theses it is only possible to draw some conclusions on the emergent or meta level. We can see, as Trench and Bucchi (2010) describe, a field of formal study in which PhD theses critique the processes of science communication based on various disciplines such as psychology, communication studies, social studies of science. We can also see that all the domains Mulder et al (2008) mention are incorporated in this collection of PhD theses. But none of the theses we have information on critiques the supporting disciplines themselves and there are no theses found so far outside of these discipline boundaries that reflect on science communication. This means that science communication research is broadly in line with where it all started: science and its (needed) societal impact.

Discussion

Is there a clear rhetorical opportunity within these meta boundaries? Science communication makes science tangible by reflection, analysis and synthesis. It is made - tangible through its distinct parts becoming visible in the media and in science communication strategies. The possibilities and impossibilities of science in its societal function become visible through communication.

As it is stated by some of the theses reviewed, when a researcher has a clearer vision of science and its societal impact by means of science communication, the practice of actually doing research is understood much better. Science communication is much more ‘science’ than ‘communication’. However, once you know what to communicate by using communication theories, you know how to communicate. But this communication process itself again is more about science and its impact on its target audiences. With regard to the question of science communication as a discipline the outline of the reviewed theses and the reflection on it might show that we need to think in a reversed mode and conclude that we are a sub-discipline of social studies of science making use of the theories and methodologies of communication to reflect on science and its social importance and interaction. We understand the social studies of science from a communication perspective. Science communication needs to critically engage with communication theories if it is to be recognised as a communication discipline.

This requires much deeper investigation, including analysis of how this PhD research contributes to the theoretical development of the research groups from which it comes. This is a topic that might be part of the agenda for an international gathering of PhD researchers in an international PCST-Graduate School (virtual or physical, or both) that would promote profound thinking on science communication, its starting points and practical implications on the practice of science.

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A Study on Science Popularization Work in Community from View of "Last Mile"–Take a Case of Science Popularized Community in Beijing

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Abstract. Based on the investigations and interviews among totally of 123 science popularized communities in Beijing from 2007 to 2010, this paper mainly discusses science popularization work in community from the view of "last mile". According to the general communication model of mass media, there are four basic elements during a communication procedure: information sender, information, communication channel, and information receiver. The paper first talks about the present situation of four aspects of science popularization work in community. Then, the paper analyses the problems existing in the popularization work in community concerning the four aspects. On the basis of some theoretical analysis such as pluralism of subjects and two-way communications in the science popularization, the paper last gives some concrete suggestions for the future development of science popularization work in community.

Keywords: Science popularization; Community; Last mile

Background

Since 2007, I have attended the evaluation of totally 123 science popularized communities in Beijing annually, and I have investigated and interviewed half of these communities on-the-spot. Based on these investigations and interviews, this paper mainly discusses science popularization work in community from the view of "last mile" ---- which means to change the traditional view of up down to the view of bottom up concerning science popularization work.

According to the general communication model of mass media, there are four basic elements during a communication procedure: information sender, information (content), communication channel, and information receiver as following:

information sender → information → communication channel → information receiver

model (1)

As science popularization work in community is concerned, the four basic elements and questions we would like to analyze are as following: subject of science popularization–who sends the information, information of science popularization–what is the content, communication channel of science popularization–by which channels the information is sent, and object of science popularization–to whom the information goes.

Situation of science popularization work in community

In this part, we will talk about the present situation of four aspects of science popularization work in Beijing communities:

Subject of science popularization, usually there is no professionals for the science popularization work in the community, few of the people who are responsible for this work have the relative higher education background or academic training opportunities. As a result, most of the people who are responsible for the science popularization work in the community have little recognition about science popularization, and there is no need to mention the new trends and new methods being used by them.

Content of science popularization, the change rates of contents in the most communities are from once a season to once a half year or a whole year, some communities even have never changed the contents which are eternal as they said! Usually the communities can get some popularizing materials from local bureaus of government especially when there are public hot issues such as SARS in 2003, Olympic Games and earthquake in 2008, in their routine times there are no regular content support of science popularization from government. Some communities can get information of science popularization from books or internet, but even they can surf on internet, many of the workers still can not judge which information are right facing so huge and various opinions on internet.

Communication channel of science popularization, with more and more money from government invested into the grass-root units many communities have built up "digital harbor"(with dozens of computers for residents surfing on internet), LED (Light Emitting Diode) panel to show the content electrically, and DIY(Do It Yourself) Corner with various instruments for science popularization activities, etc. However, with the government paying more attention to the advanced methods the traditional methods and channels of science popularization such as books, magazines, blackboard notice, are neglected in the communities.

Object of science popularization, generally speaking the ordinary residents in the communities are negative to the science popularization activities which shows as very small part of them attend the lectures(maybe they even don't know them) or go to "digital harbors" and libraries as most of these instruments are not opened normally and regularly. The other important reason is the activities, lectures, "digital harbors" are not connected with the daily life of the communities, and the local people also are not used to applying some new advanced techniques such as internet, electric books.

Problems existing in the popularization work in community

In this part, we will see the problems existing in the popularization work in community concerning the four aspects, which are mainly appeared as following:

The shortage of subject of science popularization work, there are not full time workers for this kind of work and also the have few opportunities to get professional and academic training. There is not a content support system for science popularization of the community from outside such as government, university, or academic association, etc., as a result the community has no capability to find and choose right, enough and suitable information for routine science popularization work.

Too much attention on advanced channels and neglect of traditional ones of science popularization, such as newspaper, magazines and books which are still the important even the main ways for especially elders and people in rural areas to get science and technology information in their daily life, they are not used to so called "advanced channels" as internet. Ordinary people in community have small chance to participate the science popularization work, usually there is few care about their needs, expectations, feelings and habits concerning science and technology by the traditional popularization way of up down.

Theoretical analysis of popularization work in community

The new orientation of popularization of science

According to the traditional notion, the aim and main function of science popularization (SP) are just how to improve the scientific knowledge level of the public. And of course scientists are only authoritative experts who can popularize the science to the general public, which also supports the opinion that SP is a uni-direction knowledge flow from scientists to public.

The investigations of Chinese civil (from 18 to 69 years old) science literacy (SL) by Chinese Association for Science and Technology (CAST) have held individually in 1992,1994,1996, 2001, 2003, 2005, but only in 2001 and 2003 the reports of investigation were published. From the results of these two investigations we can see that the Chinese civil science literacy level increased obviously with the increasing number of formal education years of the public in school:

Table. The SL level (%) of Chinese people with different formal education stage

Investigation Year / SL / education grade	Under primary school	Primary school	Middle school	High school or prof-school	College	University and above university
2001	0.1	0.0	0.3	1.6	7.0	11.5
2003	0.0	0.0	1.5	6.2	10.7	13.5

Data resource: 1 The Chinese civil SL investigation project team, The Investigation Report on Chinese civil Scientific Literacy in 2001, Beijing: Publishing House of Science Popularization, 2002, P60; 2 The Chinese civil SL investigation project team, The Investigation Report on Chinese civil Scientific Literacy in 2003, Beijing: Publishing House of Science Popularization, 2004, P20

In China the general public accepting the systematic science formal education in school is only beginning at middle school stage, which means Chinese people who have just primary or under primary education in school or kindergarten could not get the science education experience, and these kind of people in China are more than 100 millions far more than the whole population of Germany. The SL level of these people, which contributed mainly by SP during their life span from 18 to 69, is nearly zero according to the investigations in both 2001 and 2003. So, if taking China for example, according to several investigations of civil science literacy by CAST, PS in fact contributes very little to the improvement of scientific knowledge level of public especially compared with the formal science education in school.

In fact, general public is not the school student, on one side, they have not enough time and energy to continue to learn so huge amount of scientific knowledge, and on the other side, the interests and needs of public to science are so various and change frequently during their life span that just to improve the scientific knowledge level of public is definitely not a cure-all.

As a result now we'd better get a new orientation of PS today which means instead of asking people to get to master more and more science knowledge, it's quite suitable for PS nowadays to meet various needs of public such as material benefits, recreation expectation, and democracy right etc. concerning science issues in modern society.

The role change of scientist in the popularization of science

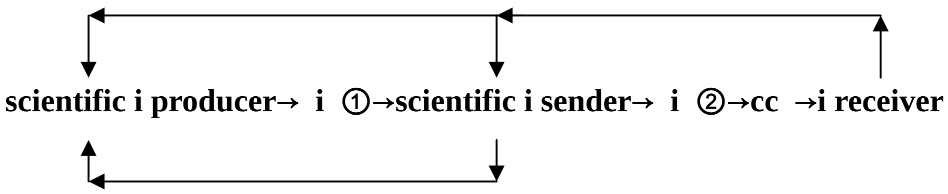
Since a long time ago, it's commonly accepted in the science community that scientists should act the subordinate role of the popularization of science. And it's true that in the history of science, scientists always play not only an important but also central role in the PS. Many most famous scientists engaged their lives in popularizing scientific knowledge to the ordinary people as they realized that popular science work was an inalienable part of their scientific research activities. Thanks to their endeavors, more and more general people turned to accept, support, and even like science. Just as Carl Sagan objectively appraised Isaac Asimov in 1992 that we never know how many scientists working at the scientific frontiers got their initial inspiration through a book, an article, or a story written by Asimov, we neither know how many ordinary people support the science at the same reason.

From model (1) which we mentioned in Background, we can see that the information sender sends the information through the communication channel to the information receiver. But, in this traditional model there is a tacit premise which means that information producer is also the information sender, they are the same one. This is common in the general news report, the journalist is both the information producer and the information sender. And it's also the case that in the early time of SP scientists played as both the scientific information producer and the scientific information sender, the most representative figures were such as Galieo, Michael Faraday and also the Royal Society of UK.

However, nowadays the popularization of science has been showing new characteristics. First, in the information and networking society, especially due to the appearance of television and internet, the mass media is playing an increasingly prominent role in the PS as mass media has become the first choice for public getting scientific information on one side, and scientists have to rely on mass media today to do some popular science works on the other side. Second, popularization of science is also becoming a professional area as science communication becomes a major for more and more college students, the content and style of PS also changed too which maybe a bigger and bigger challenge to scientists. Take the content for example, according to an investigation by Royal Society of UK on the attitude of scientists and engineers to science communication to public, "three quarters of the scientists feel able to communicate their own research, whereas slightly less than half of them feel that that they are able to communicate the social and ethic implications of their research ". These new changes will surely affect the ways and traditional role of scientists in the popularization of science.

In the modern activities of SP, we can often see that the scientific information producer and the scientific information sender have been separated. Scientific journalist, as the scientific information sender, more and more faces directly to the public than the scientist, and the latter as the scientific information producer, is often behind the journalist and provides various professional helps to him. So today it's not difficult to see a diversity and specialization trend of subjects of popularization of science.

And then we suggest a new model of scientific communication as following:



i: information
cc: communication channel

model (2)

In model (2), we divide "information sender" in model (1) into two parts: scientific information producer and scientific information sender; and divide "information" in model (1) into two parts too: information ① and information②. And form model (2) we still can see the feedback from information receiver to both scientific information producer and scientific information sender, and feedback from scientific information sender to scientific information producer too.

From the new model of scientific communication, we can conclude that mass media workers (including scientific journalists, scientific editors, popular science writers, organizers of popular science work, etc.) who as the scientific information sender will be the main, direct and professional subject of popularization of science. Scientists, while as the scientific information producer, will be the indirect and unprofessional subject of popular science work.

So, the diversity and specialization trend of subjects of popularization of science are unavoidable especially due to the mass media development in this scientific and democratic society, the traditional role of scientist in the popularization activity of science would also be changed accordingly. Scientific community has to face this reality and adapt to the new trend of the SP.

Conclusions and Suggestions

In recent years, with more and more money from government invested into the grass-root units many communities have got advanced hard wares for science popularization works, however with the delay of soft ware construction such as content system, professional training, operation and evaluation mechanism of science popularization, etc., some new problems gradually appear and some old problems are still there in the communities.

Based on the investigations and analysis, we give some concrete suggestions for the future development of science popularization work in community, mainly as: Training professional workers annually for the science popularization in communities, and also training scientific journalists, writers and exhibitionists for communities.

Providing science contents steadily from scientific authorities for the communities such as building science popularization content database or S&T medias, which also should concern with the daily life of different communities. Building up various communication channels for science popularization including both advanced and traditional ways in communities. And lastly inviting local people of the communities participating in the program and evaluation of science popularization work as the bottoms-up way asks.

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Science and Technology in TV: the cases of Greece and Cyprus

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Abstract. This paper aims at a full mapping of TV science programs in Greek speaking media (i.e. Greek and Greek-Cypriot media) as well as at linking some critical structural characteristics of these programs (i.e., format and content) with audience reception. The study constitutes part of the European funded (FR7) project "Audio Visual Science Audiences-AVSA" coordinated by Free University of Berlin which conducted a structural analysis of science programs in 13 European member states and investigated their reception by different segments of the public.

Keywords: Audience data, Public perceptions of science programs, Science and technology programs

Introduction

The principal objectives of this study were: (a) to identify and classify science television programs in Greece by type; (b) to correlate audience data with science program types; and (c) to investigate audience responses to specific program types.

In most of the EU member states, there are several weekly television programs on science. Alongside programs comprising reports and discussions of new developments in science generally, there are programs with a more restricted focus, e.g. on astronomy, and there are big-budget documentaries on major topics. The level of production of such programs varies very considerably across Europe. In Greece, there are currently under 20 TV programs about science, technology and health produced by both public and commercial channels. In other European countries such as Germany, there are more than 40 television programs dedicated to science and technology, many of which have been introduced recently, and that number does not include health/ medicine programs (AVSA, 2010).

Television science reinforces the legitimacy and sacredness of science (Dunwoody, 2008). This is due to the way science is presented, as producing solid, straightforward mostly positive results, as well as how scientists are presented as experts and quite apart from other professionals. Evidence presented in the Special Eurobarometer survey, Scientific Research in the Media (European Commission 2007) reveals that the strongest preference among sources for information on scientific research was by a wide margin for 'traditional TV channels' – 34% in the EU, ranging from 27% in the UK to 62% in Greece. However, in the whole of Southern Europe (Greece, Cyprus, Spain, Italy, and Portugal) and also in Eastern Central Europe there are relatively few science programmes (AVSA, 2010). This is most likely not because the audience would be less interested than in other places but the lack of provision is a result of the precarious financial situation of the public service broadcasting sectors in these countries.

The current study constitutes part of the European funded (FR7) project "Audio Visual Science Audiences-AVSA".

Method

Identification and categorization of science programs

The sample contains all science programmes broadcasted within three reference weeks in 2007 and two in 2008. Programs were selected: (a) if the words 'science', 'research', 'knowledge', 'technology', 'computers', 'environment', 'health/medicine', 'discovery' or the name of a scientific discipline (including social sciences) were in the title, subtitle or description of the programme in guides or the internet; (b) if they were on the webpage of a channel under a category whose title contained clear references to science, knowledge, technology, medicine, environment or the name of a scientific discipline. The programs were categorised by type according to the following typology. Popularisation programs (documentaries) typically present science in a factual and informative manner, often consisting of interviews accompanied by narration. Topic areas can include astronomy, engineering, history etc. Advice programmes give advice on healthier living or how to save energy tend to involve lay people. Selection of topics is guided by the necessity to provide the audience with practical tips. Edutainment programmes. The agenda is not guided by science observation but by the aim to educate and entertain the audiences. However, scientific explanations are typically only a minor part of the programme and personalities such as artists or sportsmen often dominate the scene. Typical examples of Information programmes are science news broadcasts which are characterized by short preparation time and specialization in observation of current events within the science system. Advocacy programmes focus on happenings stemming from social systems other than science, especially politics. Environmental protection is a central topic in this programme type.

Audience data

TV ratings were collected for each science program broadcasted in Greece and Cyprus from a private media research company keeping a systematic data base. Socio-demographic characteristics of the audience were also collected (age, gender, educational status).

Focus groups

The purpose of this part of the study was to elicit participants' judgments about the three clips shown as representatives of their corresponding types and identify the criteria or the ways in which they make these judgments. Participants with specific socio-demographic characteristics were recruited for the conduct of eight focus groups.

Table 1. Composition of the focus groups

Group	Description
Group 1	Participants of mixed gender (preferably balanced) recruited from vocational schools, under 20 years old.
Group 2&4	Participants of mixed gender (preferably balanced) recruited from lists of science teachers, amateurs scientists, science museum visitors, etc.
Group 3	Participants of mixed gender (preferably balanced) recruited from upper secondary schools, 15 to 17 years old.
Group 5	Participants of mixed gender (preferably balanced) who are well educated (university degree), between 30 and 49 years of age.
Group 6	Participants of mixed gender (preferably balanced) who are 50 + years of age, well educated (university degree).
Group 7	Participants of mixed gender (preferably balanced) who come from mixed educational backgrounds and are between 30 and 49 years of age.
Group 8	Participants of mixed gender (preferably balanced) who are 50+ years of age and come from mixed educational backgrounds.

Participants were recruited after responding to a screening question 'how would you rate your interest in science? If participants responded with 'very interested' or 'quite interested', then they were asked a series of questions regarding science related science activities and how often they engage in them ('Do you regularly, occasionally, hardly ever or never…? a) Watch TV programs about science, b) Listen to radio programs about science, c) Buy specialized press about science, d) Look on the Internet for information about science, e) Read science articles in general newspapers and magazines). Sessions lasted approximately 2 hours. The stimuli were presented to the participants on the TV set and the whole discussion session was recorded. Moderators attended a training workshop organized by professionals in the field before conducting the focus groups discussions. The stimuli used during the focus group discussions were broadcasted in 2008 and 2009. One stimulus from each type was presented. This typology is a continuation of the work by Lehmkuhl (2007).

Type 1–Science news report: This clip was part of a news program, lasted for 2.5 minutes and it discussed a medical advance i.e. a cure for individuals suffering from Type I diabetes. The report included statements from researchers and diabetes experts from the U.S. and Greece. Type 2–Report on big issues of science: The program chosen was an episode of a documentary series called "The universe I have loved". The clip dealt with whether there was ever extra–terrestrial life on Mars. The presenter is a scientist who takes the audience through the latest scientific discoveries on this topic. Type 3–Report on scientific explanations of the everyday world: 'Analyze this', is a weekly program presented by a psychologist who discusses topics stemming from "how and why" questions of our everyday experiences. The clip presented dealt with the issue of "why we need sleep" and explains what happens during sleep, sleep stages and sleep disorders based on latest scientific findings and lasted approximately 3 minutes.

Results

Program types

Nineteen science programs were identified in Greece and three in Cyprus. The majority of programs were related to health/ medicine but the rest touched a variety of topics such as the environment, the universe etc. In Greece, we identified 9 Popularisation, 8 Advice and 2 Advocacy programs. It is worth noting that there is a complete lack of edutainment, which in most of other European countries has become extremely popular and information programs (AVSA, 2010). All three programs broadcasted in Cyprus, were Advice programs.

Audience data

The viewership data show that the available science programs are watched by relatively low percentages of the population. Due to the lack of a large variety of different types of programs and the low audience numbers in Greece and Cyprus, it is difficult to determine whether different segments of the audience (age groups, educational background, gender) have different preferences with regards to the type of program. However, in Cyprus, a country whose population is slightly over 1 million, the average number of science program viewers is 17.000, of which 12.333 (72.5%) are over 50 years of age.

In Greece (potential viewers: 9.356.888 individuals) data revealed that advice science programs related to health and medicine have on average more female than male viewers. Moreover, the majority of viewers of programs related to health and medicine are over 50 years of age. In contrast, documentaries have more male than female viewers while advocacy programs have an equal number of male and female viewers. On average, science programs have more viewers with a medium education followed by viewers of a low education while there are fewer viewers of a high educational level. It might be the case that the size of an audience is more determined by scheduling than by different preferences expressed by the public.

Specifically only three programs were scheduled within prime time zone (9pm-12pm) while three programs are scheduled in the after midnight zone (12pm-6 am), seven programs in the morning zone (6am-13pm), six programs in the early afternoon zone (13pm-17pm) and three programs in the pre-prime time zone (17pm-21pm). This finding does not necessarily support the notion that the audiences just watch what producers want them to watch, or that audiences must be considered to be passive consumers of what is scheduled on their preferred channels. However, it highlights the need to perform an in-depth analysis of the factors which influence viewers' preferences.

Table 2. Audience data according to program content (absolute numbers)

Content	Average number of viewers
Health programs (7)	62.000
Space (2)	32.500
Generic science (2)	32.500
Environment (5)	31.000

Table 3. Audience data according to program type (absolute numbers)

Type	Average number of viewers
Advice (6)*	69.000
Popularization (9)	31.222
Advocacy (1)*	24000

*missing data from 1 Advocacy program and 2 Advice programs

The majority of science programs in Greece are related to health/medicine which is evident even from the titles e.g. 'Secrets to good health', 'Health for everyone', etc. The environment is also a very popular topic e.g. 'Eco news', 'Ecology and diet', 'Thirsty planet', etc. There are some programs concerned with the universe or space e.g. 'The universe I have loved' and 'The sensitive universe'. A small number of mini-series programs deal with different scientific issues 'Magically simple' or 'Science Nova'.

Clip assessments

Clip 1: Science news report

Content: The majority thought that the medical breakthrough is interesting and worthwhile to present during mainstream news since a large portion of the public might be directly or indirectly affected (Group no. 1, 5, 6, 7, 8). The only criticism received was from younger participants who supported that the issue was not analyzed in depth and thus narrowed the intended audience to those affected by diabetes, experts or families (Group no. 3). Participants judged the best feature of the clip to be that scientists had the opportunity to talk about their research and what it means to them. Also, that it gave information on what would be the latest news from the medical community. They thought the information provided was better documented as experts were talking about the issue. Participants found the clip aimed to inform people about the direction research is taking however it also transmitted a feeling of hope.

Way of presentation: Participants thought that it was a good choice to present this topic with many speakers and expert opinions within a working environment i.e. lab. (Group no. 5, 6, 7, 8). One participant said "It was very forward of them to use 3D animations in a news clip" and commented on the role the scientist had in the clip "Did you see the scientist in the lab? They made an effort to present the scientist in a different light" (Group no. 2). However, other participants felt that the information presented was not understood by everyone and that the only information essentially offered is that the therapy for diabetes is very close. Some participants from group no. 2 thought that medical breakthroughs are presented in news so often that they have sort of lost their credibility. Also, that there was a fake air of "scientificness" about this clip such as the presence of some terms and images and this was a negative aspect to this reportage according to the participants. This was attributed partly to the fact that the journalists presenting the topic were not scientists themselves and partly due to the way of presentation – quick pace, a lot of information etc.

Context of media output production, its effect on public awareness of S&T: Participants from mixed educational backgrounds aged 50 + pointed out that reporters of health issues (or science issues in general) should be specialized in this–not just any reporter (Group no. 8). Moreover, it gives people the motivation to search in depth about this topic (Group no. 7). Some participants felt that the medical breakthrough should not be presented as if the solution is already there and give false hope "There is an ethical dilemma however–scientists have responsibility when presenting a health topic" (Group no. 2). Participants also mentioned that news is usually presented in an overdramatic way because the program broadcasters sometimes are more interested in triggering a sensation rather than presenting credible information i.e. this can have the effect of scaring people–the example of the flu vaccine H1N1 was given (Groups no. 1, 3). One participant felt that the media "use" medical breakthroughs to create a sensation (Group no. 7) and that it would be much better to actually announce a breakthrough when it is already used or applied rather than announce something which is still under investigation and give people false hope (Group no. 7).

Clip 2: big issues of science

Content: Participants thought the clip was interesting as it was not narrow in focus but rather approached questions which have preoccupied scientists for a long time "interesting and larger than life' (Group no. 5).

Way of presentation: Participants made quite a few negative comments regarding the presentation style. Specifically, participants thought that the two professors presenting the program had not been advised by TV people so that the end product is more appealing to the audience. "The presence of scientists contributes to the reliability of the program. But experts are not experts in communication! I understand that programs are presented by scientists to enhance status but in this case they should receive some training on communication" (Group no. 2). The majority of participants felt the tone was "didactic" and the presenters spoke "painfully slow". They thought that this production is actually representative of Greek state TV and if this was presented by SKAI, a private channel it would be much more interesting. Younger participants judged the clip to be boring and the effort to dramatize the issue it dealt with not successful at all "this music they use, it is like a thriller, spooky" (Group no. 3). Participants did not doubt the credibility of the images presented in the background. This could be attributed to the fact that the images presented behind were not so sophisticated i.e. 3D graphics etc. but mainly showed generic images from space. None of the participants doubted the status of the scientists and the information they conveyed. The majority of participants irrespective of age and educational background judged the fact that the program was presented by professors who knew their field of study well as a positive thing. In fact, some mentioned that this was indeed a scientific program with *real* scientists "Purely scientific. It encompassed history of science, methodology and began to answer a scientific question" (Group no. 2).

Clip 3: scientific explanations of the everyday world

*Content_*: The majority of participants felt that a daily life topic is much more personally relevant and accessible to everyone compared to other scientific topics such as big issues in science.

Way of presentation: Participants both criticized and praised the set up of this clip. Younger participants especially thought that it was much more memorable since there was a quick pace, easy language and that the topic was approached in a way so that no issues were unaddressed (Group no. 1, 3). Others judged the program structure positively as it went from general to specific, it was of short duration and there was limited information presented on a single topic in a concise way (Group no. 5 and 7).

All participants thought that the summary points presented at the bottom of the screen were really helpful for viewers so as to retain information better. It was mentioned that the program was successful as it combined image, sound and text. Others felt the strong point was that the presenter mentioned results from research studies (Group no. 8).

However, participants also commented that this program seemed more like an advertisement or that it was like opening up an encyclopedia. They thought the format of the program was unsatisfactory as the production team cannot expect the audience to "have an appointment with the program" i.e. go out of their way to watch this program since it only lasts 5 minutes. A program of such short duration does not have such a strong identity – no viewer will rush home to watch it as there is such a huge possibility that viewers might miss it (Group no. 7) however a healthy young person is very suitable to give health related advice (Group no. 7).

However, most participants heavily criticized the clip as they felt that this was a cheap production only based on the appearance of the presenter "the particular presenter was chosen because of her looks and because she would attract more viewers". Furthermore, most participants thought that she was not convincing in her role "these programs should be presented by a scientist so that the information is correct and credible" (Group no. 3).

Conclusions

Research findings indicated that there are few science programs broadcasted in Greek and Cypriot TV of which most are popularisation and advice programs while there is complete lack of Edutainment and Information programs. Another important observation is that the scope of topics used is very limited. The majority of programs concern the areas of health/ medicine and the environment. Furthermore, science programs audiences are very low. However, older viewers and of lower educational background tend to follow health related programmes falling within the “advice” type in a more systematic way.

Findings of the focus group discussions indicate that the majority of participants believe that the production and broadcasting of science programs is primarily the responsibility of public channels. However, most of the science programs in Greece are broadcasted by a single, private channel and mainly produced abroad. Findings also show that participants have a set of specific criteria according to which they judged scientific programs. These included personal relevance of topic, the presentation/set up of the program, the presenter/scientist presenting the program, the scientificness and the reliability of the program. Some differences were evident between different segments of the public. For example, reliability of the presenter and the information was more important to participants with a higher education while younger participants were more concerned with the presentation of the program. Content was a relevant criterion for all participants however, participants with a higher education judged the big issues in science clip and the science news report clip in a more positive light. Conversely, participants of a lower educational background judged the clip on scientific explanations of everyday world more positively. These findings could open up the road for benchmarking S&T presence in TV as well as contribute towards a better understanding of the elements different segments of the public would appreciate.

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Reviewing Science Education Reforms and Science Literacy for All

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Abstract. There is need for creating a universally scientific literate society through "Science Education for All". What is needed in this regard is to popularize science and consumerize technology. The presentation gives a brief analysis of the definitions of scientific literacy in relation to language literacy, dimensions of scientific literacy in the contexts of sustainable development and understanding of science as a social enterprise .It examines the role of science, technology mathematics education into a human enterprise for creation and sharing knowledge and developmental capacities to design envisioned future technologies for the benefit of mankind for peaceful co-existence. World science declaration 2000+ is corner stone of policy frameworks for reforms for science, technology, mathematics education for all. Some suggestions for Common curriculum changes are diversification, International competitiveness and issues of ethics and public understanding of science and technology and expected education reforms for promotion of scientific literacy at every level. Recasting the science, technology, and mathematics education for more relevant to needs, aspiration and interest of society is essential for popularization and communication of science and technology.

Keywords: Science and technology, Scientific literacy, Science Education for All, Science, technology and mathematics, Science, Mathematics and technology education, RMSA, NCAER, ISCA, IMSS, INSA

Introduction

The Importance of science and technology (S&T) in every aspect of our lives in progressive nation like India has been restated many a times in important S&T resolutions (1-3). As the world becomes increasingly more and more scientific and technological increasing one's scientific literacy (SL) is very important. The future of mankind depends on the enhanced effectiveness of education for growth of scientific literacy and its application especially for making personal and collective political decisions that can sustain our economy and democracy. We need to create a universally scientific literate society through "Science Education for All" (SEFA) the guiding principle in this regard is "popularize science and consumerize technology.

The American Association for the Advancement of Science (4) defined scientific literacy as the ability to use scientific knowledge and ways of thinking for personal and social purposes. Attempts have been made to define scientific literacy in relation to language literacy by several educationists (5-8). Despite some differences, whether scientific literacy is not dependent or dependent upon any specific science content or process knowledge the dimensions of scientific literacy include the following.

- Science content: understanding facts, laws, concepts and theories
- Scientific inquiry: understanding of the scientific approach to inquiry
- The ability to define scientific study and to discriminate between science and non-science
- Equal importance of science content and science processes equally
- According to Project 2061 scientific literacy (9) has many facets. These include (i) familiarity with the natural world and respecting its unity; (ii) awareness about the important ways in which science, mathematics and technology Education (STME), depend upon one another; (iii) understanding some of the key concepts and principles of science; (iv) developing capacity to understand the scientific ways of thinking and its importance; (v) knowing that STME are human enterprises, and (vi) understanding the implications about their strengths and limitations. All most all, subsequent definitions (10-12) of scientific literacy have been weaved around these facets.

Third International Mathematics and Science Study (13) (TIMSS) defined few additional objectives in this regard, viz.:

- Education for universal science literacy will, in addition to enriching everyone's life, create a larger and more diverse pool of students who are able and motivated to pursue further education in scientific fields.

- The first priority of science education is basic science literacy for all students, including those in groups that have traditionally been poorly served by science education.
- For students to have the time needed to acquire the essential knowledge and skills of science literacy, the sheer amount of material that today's science curriculum tries to cover must be significantly reduced.
- Effective education for science literacy requires that every student be frequently and actively involved in exploring nature in ways that resemble how scientists work.

STME for Sustainable Development

The understanding science as a social enterprise (14-15) is necessary for sustainable development. The broad access to scientific information is key for the people to understand, participate and respond to the challenges that development poses to civilization. Understanding of issues such as environment, global warming and climate change, air quality, loss of biodiversity, evolution, implications of genetic research, human health, hazardous substances, population growth ,world hunger, water resources, energy security, degeneration in agriculture and many other topics is essential, almost a requisite, for personal involvement in searching solutions for these issues. Thus education with science, technology and Mathematics (STM) base is crucial to sustainable development. It is challenge for science educators all over the world to converge STME into a human enterprise for creation and sharing knowledge and developmental capacities to design envisioned future technologies for the benefit of mankind.

Science Literacy for All (SLFA)(16)

- World Declaration on Science 2000+: “The declaration on science and use of scientific knowledge is part of the right to education and right to information belonging to all people for human development and creating of endogenous scientific capacity”.
- There is need to improve, strengthen, diversify and restructure STME both formal and non-formal with the objectives for sustainable development.
- STME can contribute to peaceful co-existence. It should not be seen as an instrument of warfare. It can be used as knowledge for conflict resolution by including subjects such as energy, pollution, environment, health care, medicine and use of resources and application of bio-technology, nanotechnology and nuclear energy for peaceful purposes.
- The society and Government must take responsibility for the same because the STME’s spirit and scientific temper in society can contribute to respect for human rights and dignity of labor.

Post Sputnik Science Education Reforms

The main emphasis of the above reforms (17) undertaken during 1900-1950 were teaching of science as structured discipline to limited students in what, why, How, types and content of courses. The focus was not SLFA. But in India Kothari commission report (18) stressed need to transform education as per the needs and aspirations of people and focused on education as key to national development and importance of science education in this regard. The Kothari commission report expounded “Science has added new dimension to education and its role in the life of the nation, but central to all this is the quality of education. If science is poorly taught and badly learnt, it is little more than burdening the mind with dead information and it could degenerate even into a new superstition. What we desperately need is improvement in standards of science education at all levels”.

Three major goals of STME identified were in the report viz:

(a) Prepare excellent Scientists (b) Training of teachers in new frontiers of knowledge

(c) Produce scientific literate society.

It shifted emphasis from knowledge process to skills and attitude of mind and also interaction between worlds of knowledge with the world of work.

However, few distinctive drawbacks of these gigantic efforts were noticed as a result teacher proofing of curriculum, over emphasis on computer assisted learning, loss of interest of students in science and mathematics, and domination of university and research scientists alienating initiatives of school teachers in classroom situations. The assessment and evaluation did not receive a proactive support of scientists dealing with the reforms also. However, it impacted the thinking of scientists and educators equally in third world countries and brought together scientists, educators and teachers at all levels on a common platform for new resurgence characterized by sharing of knowledge and experience for worldwide paradigm shifts in approach to STME

Revival of STME at National Level

The State of STME is at center stage again at national level because of global concerns for sustainable development, economic growth, better quality of life and "science education for all"(SEFA).

The second reason is renewed importance of basic sciences as expressed in the statement of Nobel Laureate Aaron Ciechanover at ISCA 2007. He made an appeal for global focus on basic sciences rather than application for the research being funded. "If you don't have basic science, there is no applied science". Similar sentiments were expressed by science fraternity participating in INSA Initiatives on improving science teaching viz.

- Science education seminar, INSA–May 2002(19)
- Science education INSA Workshop–Oct 2002
- INSA report on science education in universities and Inter Academy discussions on improving science teaching.
- The national curriculum framework 2005 has elaborated the goals of S&M curriculum for schools.
- The recent NCAER 2005, India Science report gave the picture of state of science education in India.

All these reports examined various conceptualities for improving STME in India including poor quality of education, lack of experimental facilities, absence of good quality teachers, need for attracting good talent and removal of inadequacies in curriculum.

A brief overview of the science curriculums, textbooks, and teaching continue to lack focus and to emphasize quantity over quality. The definition of literacy must expand to include not only reading and arithmetic, but also science, mathematics, and technology. The life-enhancing potential of science and technology cannot be realized unless everyone understands the nature of these subjects and acquires basic scientific habits of mind. Without a science-literate population, the outlook for a better world is not promising. The STM education is considered an important component of science education (SE) in schools from K-1-12 levels all over the world to promote SEFA in view of universalization of secondary education(21) under Rastriya Madhymik Siksha Abhiyan (RMSA)-2009(22-23).

State of STM Education in Schools in India

The recent NCAER 2005, India Science report (24) gives the picture of state of science education in India. Some of the facts in this regards are:

- It is well known that good talented students are not opting science courses. It is worldwide trend and India is no exception.
- After 10 + 2 students enroll for B.Sc. degree only if they fail to get admission to courses like engineering, medicine, and commerce. Only 25% of entrants in K-12 system complete science courses. 10% recipients of National Talent search scholarships opt for science courses. The Percentage of student joining science has declined from 31% to 23.3% since 1990.
- Studies are not enjoyable and cannot attract students and there is dearth of good teachers. And the cost of higher education in science is higher and non-affordable. The infrastructure and laboratory facilities are in adequate also
- absence of brand institutions and resources for up-dating of learning material, laboratories, teacher training, lifelong professional development of teachers and promotion of basic research in methodology of science teaching.
- Limited job opportunities offered by the courses in vogue in school education i.e. vocational chances are limited at terminal level school science education.

Changes are also needed to meet requirements of science teaching post 2000+ such as competency in digital literacy skills in using learning technologies, knowledge of problem solving tools, inventive thinking along with marketable and practical skills applicable in effective communication.

Policy framework for STME

- The World science declaration 2000+ is corner stone of policy frameworks (20) for reforms in STME. These principles have guided the directions of developments in the field STM education in this decade.

- Science literacy for all–"no child is left" and the inquiry based and exploratory method for learning SE is used so that learner himself can construct the knowledge.
- STME can contribute to peaceful co-existence. It should not be seen as an instrument of warfare. It has to be all-inclusive to ensure gender equity, participation of all including marginalized groups, and impact of globalization, public understanding and its influence in daily life, concern for ethics, human rights and culture of peace.
- Teacher is the vehicle for desired reforms in SE. The institutionalized training (pre-service and in-service training) of teachers and their professional development must receive a central place in resource planning.
- Financial and resource inputs are necessary for developing an enabling environment for science learning. Integration of IT and communication technology in curriculum transaction for effective learning and lifelong learning.

Objectives of Common curriculum changes

- It provides knowledge of concepts and related broader contexts of STM and presents a balanced view of contents and applications. It connects facts and understanding of the factual material which includes observation, inference and application of the subject. It should helpful in inquiry-based learning and experimentation. The Curriculum changes to include history of scientific discoveries and role of STME in everyday life to make learning enjoyable also. Simultaneously it integrates with other curricular areas such as reading, writing, business and social studies.
- Laboratory experiments provide linkages between theory and practical, as well as, facts and applications. It reflects the interdisciplinary nature of STM. It is inclusive of hand-on inquiry-based activities or experiments aimed at problem solving in social contexts using examples.
- Develops appropriate science experience based on visits to industry, environment and agriculture, so that it develops a global perspective of STM for sustainable development and improved quality of life. Its digital age, so it must enhance competence of students in information comprehension, use of computers for simulation, use of multimedia tools, Internet sources for data collection and virtual learning.

Diversification of STME(20-21)

- Undertake structural reforms to improve strengthen and diversify STME to integrate with culture, promote open and critical thinking and enhance people's ability to meet the challenge of knowledge society.
- Diversify STME for many fold objectives: (a) science literacy, (b) science for skilled work force and service providers, (c) cadre of excellent scientists, through child centered knowledge and inquiry based learning (d) spreading science education in rural areas and building bridges with traditional knowledge.

STME for International Competitiveness and Ethics

- Since the science education is necessary for training of sufficient number of trained people to satisfy the scientific and technological needs of the global society, capacity building in science and scientific culture is of utmost importance.
- Ethics and human rights and necessity for culture of peace and tolerance, advancement of communication and information technology has brought human races much closer. There is need for developing understanding of globalization, sustainable development, and willingness to acquire knowledge, skills and attitude towards responsible citizenship.

Public understanding of STME at every level

- To ensure the power bestowed on human being by science is used for benefit for all and not for few.
- In developing countries, under investment, lack of policies and constant follow up activities is most importantly causing shortage of qualified teachers, appropriate teaching material and adoption of new technology as serious handicaps. All efforts are made both at national and international level to make science education internationally competitive at every level. It is necessary for meeting the challenge of globalization and trade in services of education.

- Scientific temper is guaranteed against the forces of religious fundamentalism and obscurant and dead traditions.

STME–More Relevant to Needs, Aspiration and Interest to Society

- STME for all round development (20) encompassing, intellectual, personal social and economic development as core subject at all levels to meet the needs of students for future citizenship, enabling them informed and appropriate choices about learning and career development.
- To enable students for adequate preparation for 21st century to meet present and future social needs. The changes made in the Curriculum on above counts and improvement of quality must be accompanied by concurrent changes in methods of delivery, teaching practices and learning resources.
- Inclusion of IT and computer applications as a core areas of study and sustainable development, concern for human rights, sharing of resources for quality of life for all social responsibility.
- Diversification of effective practices of STME for promotion of innovation and experimentation as part of learning support inter-alias formal and non- formal education.
- Outside class or laboratory learning through field visits, science museums, exhibitions, science projects presentation, quizzes, etc.
- Student Centered Learning and teaching in classroom and laboratory.
- Defining classroom and laboratory activities based on investigation of real life problems.
- Learning to be assessed based on how the learner uses the information and skill in constructing one's own knowledge based on investigations on relevance of STME to local environment. Development of life skills through STME is more important than only professional skills.

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From ‘Understanding’ to ‘Engagement’: The Road Ahead for Public Participation in Emerging Technologies in India

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Abstract. As India launches itself on a development trajectory in nanotechnology and other emerging technologies, and with agricultural biotechnology being around for some time and fuelling many controversies, the time might be opportune to review the role of public participation in framing science and technology policy in India. Social and political theorists, public interest groups, scientists and policy makers, particularly in the developed world, has widely embraced the concept of increased public engagement in science and technology on the premise that ‘public participation makes for better science and science-based policy’. In India, however, till date, we see a privileging of ‘public awareness’ over engagement. As enunciated by India’s Science and Technology Policy, 2003, one of the main policy objectives has been ‘to ensure that the message of science reaches every citizen of India, man and woman, young and old, so that we advance scientific temper…’ Thus, as India has engaged with new technologies such as agricultural biotechnology, nanotechnology etc., the government policy has been oriented more towards communicating science than actually engaging in a dialogue with the people on defining the course for the future. This could in some measure, be attributed to what many critics refer to as the overbearing attitude of the Indian state in its deployment of science and technology for nation building, with public participation becoming more a means of legitimizing science rather than creating room for dissent. At the same time, one can never underestimate the immense challenges for the Indian scientific establishment in communicating information about new cutting edge technologies, to a very diverse Indian population at different levels of educational and economic status. Age-groups, gender, residence in urban or rural areas is some other factors which a science communication strategy always has to keep in mind. Some of the recent developments, particularly in the context of the GM debate, can lead one to an interpretation that India is taking the first steps towards more participatory public involvement, and a tenuous engagement with diverse and dissenting viewpoints.

This paper seeks to review the current state of public participation in Indian science and technology, particularly in the context of the agricultural biotechnology and nanotechnology as well as examine the challenges and opportunities in taking the leap from participation to engagement**.** The methodology includes desk review of policy and legal documents, science and technology studies literature, media reports as well as focus group discussions and indepth interviews with scientists, ordinary citizens both in urban and rural areas etc.

Ritual Models of Risk Communication

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Abstract. Risk communication plays a crucial role in the today's public controversies on science and technology development. The dynamics that emerge in the communication between the different stakeholders involved in this kind of debates, however, have not been fully understood yet.

Three-actors, one-way communication models, such as the well-know "deficit model"–where the information flows in a line from the experts to the public, through the mediation of the mass media–fail to explain the complexity of the communication processes inherent in typical real controversies, in which the relevant information about risk is produced and spread by numerous stakeholders, i.e. not only by scientists and journalists, but also by environmental associations, citizens' committees, private companies, consumers' association, political parties, NGOs and many others.

At the same time, the "dialogue model"–that engages publics in two-way communication–appears to be not more than a *prescriptive* model, indicating how communication between experts and publics *should be* carried out, rather than describing how it is *really* carried out in a typical public debate.

What we most need to describe the complexity of the risk communication processes in a real controversy is a multi-actor and multi-directional theoretical model for public communication in which the relevant information about risk is produced and shared by numerous stakeholders, whose communication strategies are adapted to the different goals and audiences.

Moreover, numerous historical case-studies indicate that this kind of debates is not limited to the close examination of techno-scientific aspects, based on techno-scientific knowledge, but focuses on a clash between values and world-views, in which beliefs, interests and alliances play a vital role.

Both deficit and dialogue models are classical transmission models of communication, and they concentrate on three actors: the sender of the message, the transmitter, and the receiver. This transmission view of communication is the commonest in all industrial cultures and it is defined by term such as "imparting", "sending", "transmitting", or "giving information to others". Dialogue model, defined by the term "listening", adds bi-directionality at the flow of information, but it remains essentially a linear model.

Nevertheless, in a risk communication scenario, it could be useful to explore as well non-linear models, such as the ritual model of communication, characterized by terms such as "sharing", "participation", "association", "possession of common values". A ritual view of communication is directed not towards the act of imparting information, but towards the representation of shared beliefs. Ritual model can be thought of in terms of a "theatre of communication" and seems to be more appropriate in describing the dynamic communication networks between the social actors taking part in the today's public controversies on science and technology.

In the present work the author explore the opportunity to develop a descriptive, multi-actor "ritual model of risk communication" aiming at offering more insights into the comprehension of typical risk-benefit controversies and the development of more effective strategies on risk management, with particular regard to science-based decision-making.

Learning Science in Informal Environments

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Abstract. In India 70% rural population depends on agriculture and women are plays a vital role. They have extensive work load with dual responsibility for farm and house. In agriculture and allied industrial sector employs as much as 89.5% of the total female labour however their contribution does not receive due recognition. And they are not able to reap the benefit of various rural developments programmed. The development of India is burdened by its low productivity, inadequate use of available technological tools for improved crop production. Transfer of technology from research institutions should reach the users. Science and technology have been an integral part of Indian civilization and culture. Women and men have been active in science from the inception of human civilization. We have to make our communication more interesting and interactive “Still there is a lot to be done to fight the superstition and religious rituals that so deploy ruled in to village life.

Some time we do not have sufficient infrastructure to make our message effective enough, and people continue to trust witch doctor move them real doctor. So, public communication is the only way that can help them not only information discrimination but also to augment the pace of economic development. Women’s education is strongly associated with both lower infant mortality and lower fertility, as well as with higher levels of education and economic opportunity for their children. Hence a country to grow was through empowering of its women. Public communication aims to popularize science and create scientific attitude among masses. It seems to intriguing to link the common men with a complicated subject like science. The solution like hunger poverty malnutrition illiteracy conservative ideas and superstition lie in science. It can be overcome through SSG.

Now in India a newer way to organize their rural poor in particular women from farmer family as self help group (SHG). SHG concepts are influential in SHG concepts are influential in providing education on modern science and new technologies. A typical SHG has 15 to 20 members. Each block organizes five hundred to 1000 such groups. We can communicate information through workshop and training to develop a technological temper throughout the member and their families which can help us to achieve our objective.

Training method should be adjusted to the level of literacy and domestic obligation of the member. The objective should be to enhance production and improve welfare and socioeconomic condition. Training should change the attitude of member. Hence, a need arises to carry out studies in order to understand and set right their disbeliefs, negative attitudes and misconceptions. Education is one of the most important means of empowering women with the knowledge.

The present paper deals with the experience in technology transfer to rural women in different farm based activities. In all the activities women SHG were involved. They were empowered through this training programmed in a participatory manner. “Today nobody has claimed to be literate unless he possesses knowledge of science” J. L. Nehru.

Keywords: agriculture, rural women, Self Help Groups, technology transfer

The Benefit of Volunteering Service in Science Communication

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Abstract: The level of Scientific and technological innovation is an important expression of a country's comprehensive strength. Science is not only a profound paper in the magazines like *science or nature* and rely on the cutting edge lab equipments, but more depend on the desire from all the populations. Having the fertile soil, definitely would bear the rich fruit, the formation of atmosphere for knowledge desire can't exist without the communication and popularization of science knowledge. There are many ways to promote the propagation of science, for example science exhibitions and public media and so on. Science volunteer is a unique carrier and a bridge between the science and the public when they are serving in the science communication, their role can't be ignored. The volunteers themselves would be the direct receiver and practitioner while they are popularizing the science knowledge. They will bring the knowledge into their daily life virtually and influence the people around them. This essay tries to analyze the uniqueness of volunteer as the bridge between science and public in order to reveal the role they are playing.

Keywords: Science communication, volunteering service, volunteer

Opinions about Nanotechnology in Dutch Science Cafés: a Qualitative and Quantitative Analysis

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Abstract. It is now widely agreed that it is beneficial for experts and policy-makers to involve citizens and consumers in discussions about possible scientific and technological innovations and their associated risks (Flyn et al, 2009). Recent studies on social aspects of nanotechnology emphasize the need for dialogue, public participation and 'upstream engagement' (Pidgeon & Rogers-Hayden, 2007; Wilsdon & Willis, 2004). Others argue that it is time to pay attention to risks and the consequences of nanotechnology for society (cf. Royal Society, 2004). However, dialogue and upstream engagement are difficult to accomplish since the public does not always participate in science and technology issues (Dijkstra, 2008). Thus, more insight in the relationship between publics and science is needed.

In 2009, the Dutch government started a public debate on nanotechnologies. Amongst others, goals were to engage the Dutch public into nanotechnology and to discuss in a wider circle of stakeholders possible risks and benefits of nanotechnology applications. Within this framework, a collaboration of Dutch science cafés and debating centre Tumult organized a series of five debates (called: the Nanotrail) about nanotechnology and its possible applications. In a final meeting suggestions for a nanodialogue were discussed. In addition to the meetings a research study was carried out. First of all, a qualitative analysis of the science café meetings was conducted and themes and arguments expressed during the meetings were analysed. Secondly, attitudes and perceptions, and levels of participation into nanotechnology of participants of the science café meetings were analysed quantitatively and were compared to a second sample of respondents interested in science and technology but who did not visit the meetings.

Results show that science café participants were more positive about nanotechnology than the digital group of non-participants. Both groups did not perceive high risks and mostly see benefits of nanotechnology. A majority of the respondents from both groups did hear or watch information about nanotechnology and talked about it before. On average, the science café participants' levels of participation in nanotechnology were a little higher, but differences between the groups were not significant. Qualitative analysis showed that people would prefer attention for both risks and benefits of nanotechnology. If needed, research should be stopped. Also, from the qualitative analysis it became clear that there is no polarisation of the debate in the Netherlands yet, which offers opportunities for organizing debate and dialogue.

A Discussion on the Plateau Pattern of Reform

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Abstract. This article puts forward a new form of science popularization in the countryside, which is to target individuals and groups, to integrate current scientific resources and provide tunnel-like scientific service in a direct, controllable, effective and sustainable way and at the same time set up good examples and make use of their radiant effect in this process. This paper focuses on the structure, the operation and characteristics of this form. It also analyses the possible difficulties and prospects for its future development.

Keywords: Science popularization; Plateau pattern of reform; Dripping and pouring form of irrigation

Create Your Own Sustainable City–SymbioCity Scenarios

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Abstract: SymbioCity promotes holistic and sustainable urban development–finding potential synergies in urban functions and unlocking their efficiency and profitability. SymbioCity Scenarios is a simulator which aims to increase the awareness of some of the numerous possibilities local governments have available to steer their cities towards a more sustainable development. Within this area there are many valid and different points of views and small and large-scale solutions depending on various conditions and cultures. Simulation exercises have successfully been carried out with local politicians/civil servants and with high school students in Sweden, Denmark, France, Brazil and China. Available at the following address: http://symbiocity.org/symbiocity-scenarios/

Keywords: Multimedia, Urban planning, Best practices

Proposals for Societal Dialogue Framing the Controversy: The Case of Stem Cell Research in Spanish Press. *El País* and *ABC* (1996-2006)

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Abstract. Scientific advances are opened to democratic processes and how these processes are framed in the media play an important role in shaping science future policy and legislation. The dignity of the early embryo has become the central ethical issue in the public debate over the advisability of continuing human embryonic stem cell research in the last years. Embryonic stem cells are one more promising chapter of biomedical research about future treatment of Alzheimer, Diabetes or Parkinson and from an ethical point of view, these advances implies the intervention in the human nature in the very early stages. Therefore, the answer of the different actors implied and its transmission to the general public, mainly through mass media, will be determinant in future laws and public opinion. In Spain, there had been an important debate, especially from 2002 about researching on frozen embryos and from December 2006 a Law allows researching on embryonic stem cells and therapeutic cloning.

This study presents some proposals to promote societal dialogue between all the actors implied: scientists and researchers, industries, politicians, citizen associations, religious sources… from mass media perspective after going in depth in a content analysis of 2,482 articles collected from the web archives of two prestige daily papers situated in the two extremes of the ideological spectrum: *El País* (1,497) and *ABC* (984). The sample is retrieved with the keywords “células madre” and “célula troncal” from 1996 to 2006. The coding sheet has been used in *The New York Times* y *Washington Post*. The reliability has been equal or higher than 80 percent in all the variables using Cohen’s Kappa coefficient with 10% of the sample of the American study (841) in a double coding after a training period of the author in the University of Wisconsin- Madison. The variables are frames, main actors portrayed in the Spanish, European and American arena, format, source of stem cell and main topic.

The data shows that the issue is practically absent from the Spanish media in the first years when the most important are scientific advances and the coverage peaks from 2002 to 2004 when the issue turns into political arenas. This coincides with the maximum of the frame “political strategy”. Industrial aspects are absent above 90% with the frames “Market/Economic promise” and “Patenting/property rights”. The peaks of media coverage in *El País* and *ABC* about stem cells are identified when the main frames used by journalists are “political strategy”, “new research” and “ethics-morality”. Mass media have focused more on the political controversy about embryonic stem cells than on informing about scientific advances with adult stem cells. Therefore, the political debate has focused the media debate around embryonic stem cells in the 58% of the texts with less attention paid to other sources such as adult (17%), and bone marrow stem cells (7,2%).

Why INO Progress is Slow? – A Case Study

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Abstract. A well planned programme of any kind will face fewer obstacles if not no obstacles at all at various stages and from various stake holders of the society. This statement needs no proof. The India-based Neutrino Observatory (INO) Project is one of the examples of scientific faith, the international community of scientists; have on Indian scientists and India's S&T Programmes. This is one of the unique projects which will fulfill one of the dreams of Pandit Jawaharlal Nehru come true. The INO project is proposed to be set up in West Bodi Hills near Pottipuram Panchyat Union in Theni district, Tamil Nadu, India. The Rs. 900-crore prestigious project's implementation is slow, as the residents of the village, the NGO groups and Human Rights Activists pose stiff opposition towards the implementation of the project. The rural public has been educated more about the properties of neutrino by NGOs and Human Rights Activists than by scientists, science communicators or science-based-institutions in this region. We conducted a study with the help of our students and the result points out that the slowdown in the implementation of the INO project is mainly due to the absence of effective S&T communicators who ought to have been a confidence building bridges between the project implementation cell and the rural public, NGOs and Human Rights Activists. In this short presentation we will also share some more areas of concern that have slowed down the progress of the INO project.

"The customer is always right"–Mahatma Gandhi.

Environmental Aesthetics and Environmental Education in China: Status in quo, Problems and Future

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Abstract. The Study of environmental aesthetics in China begins with the translation of related western works of environmental ethnics and environmental aesthetics in 1980's. From beginning of this century, integrated with Chinese traditional philosophy, a new turning of the study of environment was formed, focusing on aesthetic view on nature, ecological critics, and aesthetics of landscape. The environmental education in China begins with early 1980's. The Chinese environmental education has some characters. First, it is a kind of non-systematic and marginalized education, which resulted in incompleteness and arbitrariness. Second, although the environment education penetrated in different levels and areas, with lack of theoretical guiding, it focus on introductory and popular but not original and individualized education. With the gradually appreciation of the importance and value of environment, the education of aesthetics of environment eventually will become important part of the environmental education. In Chinese traditional views of culture, related to human and nature, or human and environment, there are many theories could be borrowed and integrated into the education of aesthetics of environment. We can forecast that application of environmental aesthetics in environmental education will has bigger and bigger space.

Catching Them Young: Inspiring Budding Researchers for Better Science Communication

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Abstract. Science exists because scientists communicate; however, the communication of science is often seen as a necessary evil by most scientists. A national level undergraduate research conference ICARUS (Indian Conference for Academic Research by Undergraduate Students, http://icarus.org.in) was organized at IIT Kanpur to provide a forum to communicate and celebrate undergraduate student achievement in various fields of science and technology. A unique opportunity was given to the undergraduates across the country to present their ongoing research, at any stage of completion, in a public format to their peers, and the importance of good science communication was stressed throughout the conference. An introductory workshop on science journalism and communication was organized for all 88 participants in the conference. The vision of expanding and publicizing undergraduate research and inspiring the participants for better science communication was realized. NERD (Notes on Engineering Research and Development, www.iitk.ac.in/nerd), the campus science and technology magazine of IIT Kanpur, also expanded its domain of activities to promote science communication among students. SCoPE (Science Communication and Public Engagement) talk series was initiated. Distinguished science journalists and communicators were invited as speakers, who, from their expertise, shared their exemplary work and excitement, and gave the students a glimpse of what does science communication and popularization mean in the Indian context. Last but not the least, workshops on science journalism and communication were conducted in various institutes – IIT Kanpur, IIT Delhi, IIT Jodhpur and IISER Pune to stress upon the need of better science communication on a professional and popular level to truly define the scientific progress of the country.

Understanding Science is Making Commonsensible Concept System Scientific at two levels of individual and public –Based on a Case Study of Chinese People Understanding Goldbach Conjuncture

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Abstract. Based on a case study of Chinese people how to understand a Goldbach conjuncture at 1970s, this paper try to explain cooperating mechanism of concept system yielding to individual and public, and probe general characteristics of people how to cognize new scientific concept based on their own original concept system. Public understanding science, (broadly including engineer and technology) relates not only science how to be popularized through mass media or how to improve public scientific literacy but also cognitive level and method applied by a society and its member as well as cognitive social progress. In a micro individual concept systemic perspective, understanding science is making personal commonsensible concept system more scientific; correspondingly in a macro social concept systemic perspective, understanding science is making social commonsensible concept system more scientific then improving progress of social cognition level and method, as well as improving public scientific literacy.

Keywords: Goldbach Conjecture, Concept Cognition, Individual Concpet System, Public Concpet System, Understanding Science

Introduction

Since a literary report titled "*Goldbach's Conjecture*" was published at No.1 issue, *People's Literature, and* reprinted full article *at Feb.17 People's Daily in 1978,* Jinrun Chen, an outstanding mathematician, and Goldbach Conjecture, one of the 23 Hilbert's problems, became hot topic for the public of China at that time. With the gradual penetration of nationwide propaganda to public, more and more people not only knew him and his focus but also enthusiastically believed they can resolve that problem completely based on Chen's research. Jinrun Chen deeply encouraged a whole generation Chinese people, and was thought as a symbol of science. His influence, especially to people's interest in Goldbach Conjecture has been lasted so long time and reached a high tide until 2002. When we reflect this phenomenon today, we must admit that it is a typical PUS case even some persons may argue whether mathematics belong to traditionally scientific issues. In this case, an typical cognitive phenomenon people how to keep balance between the general meanings of mathematical symbolic they are familiar with and the special professional meanings depending on specific context they are unfamiliar were explored. Namely, when scientific terms beyond their original meaning known by people, how do people understand the new meaning with their individual or public concept systems. Additionally, from the perspective of concept system evolution, it also remind us merely standing at the science popularization is deficit for PUS, and is necessary to change our standpoint from scientific concepts popularization to commonsense concepts scientization.

In this paper, we first focus on tracing and comparing how normal people understand such professional mathematical concepts and gradually form fallacies about Goldbach Conjecture based on their quantitative concepts of daily life on one side; and proving that the metaphorical method of concept cognition perhaps is an important method, which play a lead role in forming those fallacies on the other side. Second, based on case analysis of first step, it is obvious when people cognize and understand scientific terms and concepts no matter individually or publically, they consciously or unconsciously apply concept system in different four levels: individual commonsensible concept system (abbreviation as ICCS, following same); individual scientific concept system (ISCS), public commonsensible concept system (PCCS); and public scientific concept system (PSCS). From social perspective, PCCS and PSCS represent public knowledge base; correspondingly, ICCS and ISCS represent individual knowledge base. Third, we explore what kind of cooperating mechanism and what are the different roles among the four levels. The theories of concept cognition already prove that four concept systems exist linear and nonlinear relationship when they interact during a specific cognitive activity. Generally speaking, the higher percent of PSCS and ISCS in public knowledge base and personal knowledge base respectively, the higher levels of scientific literacy in society and individual. Since China never cultivates really modern science and scientific spirit via its native culture from 18 to 19 century, there consequently exists a fracture stage in the proceeding of modernization and cultural evolution. From concept cognition perspective, the fracture stage means more obvious gap among four concept system categories when people take advantage of them to understanding the modern scientific knowledge, methods, function and meaning. Based on above presumptions, the important cognitive function of PUS is dealing with cognitive relationship among four types concept systems, especially leaping over or shorting the distance between ICCS and ISCS whatever for developing or developed country. No matter what kind of scientific concepts are available in their popularization, if we couldn’t pay more attention to the importance of commonsensible concepts as the precondition and background of understanding for the public and individual, we are never going to resolve the gap between science itself and understanding to science. Last, it is worthy to emphasize that investigation of concept system evolution in both aspects of public and individual not only support democracy model of science communication and suggest a more operational communication view, namely, surrounding experience of daily life makes more commonsensible concepts scientization.

Pride and Prejudice: Science Communication From Within A Science Institute

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Abstract. In a democratic society, citizens must be informed of the latest scientific advances and discoveries which are carried out in science institutes so that they can participate in the debate about the trends science will follow, its applications, its benefits and its risks. This is very important since in many modern states, in particular in Mexico, inside the National Autonomous University of Mexico (UNAM), scientific research is funded with the citizens' taxes.

Science communication should be thought of as benefitting not only individuals who have no direct contact with scientific research, but also scientists. It is important that the latter communicate their projects and discoveries: when they do so, their work gains social recognition, their institution gets exposure, and they are more likely to get funding for their next project. However, as scientists are used to discuss their work only with their colleagues, most of them find communicating their results to the general public very complicated and frustrating. Taking this into account, it is crucial for science institutes to have communication of science offices, run by professionals in the field, which function as a bridge between scientists and society.

Even though many academic institutions in America and Europe have had communication of science offices in science institutes, Mexican institutes used to consider that science communication was trivial and unnecessary. In the last few years, however, some institutes in UNAM have hired professionals to run offices whose tasks include organizing press conferences, writing articles and organizing events aimed at the general public, and doing public relations for the institute, among others.

No matter what the professional training of the communicator of science, they can never be expert in all the subjects of interest of the institute. Hence, the members of the communication team must carry out extensive and rigorous research about these areas, which are of great complexity, and in which they generally have little or no experience. Moreover, they must find the best way to communicate these subjects. In order to fulfill this objective, they need to work in close collaboration with the researchers of the institute.

In this paper, I will talk about my experiences as Head of the Communication of Science Unit of the Nuclear Sciences Institute (ICN) in UNAM, in order to discuss the interaction between the head of Communication of Science and the researchers in an institute. Moreover, I will discuss the process that begins with the publication of a scientific paper and ends with the creation of articles for the general public, leaflets, scientific journalism articles and press releases. I will also mention the way that this process has helped us in interacting with journalists, teachers, students and general audiences. Finally, I will mention how having a Communication of Science Office has positively affected the life of the ICN-UNAM.

Research on Audience's Information Behavior of Science Communication

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Abstract: Audience is one of the very important field of Science Communication. As society and technology evolving, the traditional audience of theory is not enough to explain the variety of new behaviors and phenomena. The main research content of the paper is try to use information behavior theory to explain these issues and provide a new method in research on science communication. This article from the perspective of general information behavior theory discuss that the audience's three aspects are information demands, information behavior process and effect factors of information behavior. First of all, audience's information demands are respectively explained the motives of internal factors and external factors; secondly, it is analyzed that the process of information behavior in Science Communication is formed; finally, it is the analysis of these effect factors of audience's information behavior. This paper conducts audience's information behavior in a simple analysis and induction and provides a new perspective for the Science Communication theory.

Keywords: Science Communication; Audience; Information Behavior

Introduction

Whether to investigate the dissemination of results or study the impact of media on the audience, human behavior is always a center of communication problems. Man as "audience" can only receive information in a passive communication process, it is an old point of view on the early study of communication. As early as 1959, scientists Katz's " Uses and Gratifications " theory put forward to refute this. 1980 years, Japanese scholars with a strong "information age" consciousness began to re-examine "audience" in communication and understood the audience from "passive recipients" to "active user." So people start using a new concept to describe the behavior of using and accepting mass communication and that is "information behavior" concept. In the information age with changing and developing of propagation media, the behavior that mass communication theory can not explain and do not include often in people's daily lives, especially since the process of information to form a variety of new communication behaviors, communication theory is the more powerless. Information behavior theory provide a new help to theoretically interpret these problems for us.

According Wilson generally described on patterns of information behavior in 1981【1】, based on the traditional information behavior study, combined with the communication and sociological theory, we discuss audience's information behavior of Science Communication in several aspects such as information needs, the process of information behavior and effect factors to explore and enrich the relevant "audience" of the theory.

Audience's Characteristic and Classification

The emergence and expansion of Internet in mid-90s of 20th century, humanity has entered the information age, information technology as an effective means and important ways of social life, all of the scientific and technological achievements have prompted a leap in science communication work, which makes "audience" does not longer be passive recipients of information, but mainly to search for needed information. Science communication is also increasingly from the Public Understanding of Science into the Science Communication. We believe that the audience of science communication are people who are initiative and social, and members of society who expectations and needs of the knowledge about nature and social practice has understood and accepted through effective medium.

Science Communication audience generally classified according to their form factors such as gender, age, education, industry, nature, nature of income and occupational classification. These methods are mainly based on demographic characteristics of the classification, to facilitate the classification of the audience. However, the audience should be broad, including not only individuals but also including the groups, including not only the reality of the audience should also include the potential audience. This paper argues that audience of science communication are classified by the audience's attitude so that we know more about the psychological characteristics of the audience.

First, passive audience. The types of people in the audience at this stage accounts for a significant portion. Most of the features of this group is accustomed to go with the flow, ability to adapt to survive, holding adaptable attitude, not have their own opinion, is the so-called "silent majority." However, the media pay more attention to the group reports, are especially concerned about media changes in national policy on science and the spread of social change from the direction of a look into the depths in order to make themselves more to adapt to society.

Second, active audience. The characteristics of this type is due to the will of the crowd more firm, the ability to accept new things, and a considerable part of a knowledge culture, so they hold more positive about the future attitude of most of them actively participate in science and the establishment of a new social order. And similarly, such people are also concerned about media reports, especially like to accept a lot of information is different with a conclusive report is not blind obedience and replace them with their own thinking.

Third, aggressive audience. The number of such people is very small part, but full of thought and action. This group do not mentioned in age, but have the most characteristic features of knowledge of the group. This group of people have strong ability to accept the world's advanced ideas and culture. Science Communication media is the object impacted and used, and forums which express their views to promote society for them.

Research On Audience's Information Behavior

Essence of information needs

Information behavior began in the audience aware of their own information needs, and audience will produce behavior because they have information needs. Information behavior research and information needs are inseparable. In general, the audience's information needs is the audience needs some information to meet their needs. The information needs for three types of science communication of audience is divided into domestic demand and external demand. The domestic demand of information needs of the audience is its fundamental role in information behavior and determines the audience's information behavior of the object of conduct, process and development. The external demand influence information behavior in two ways, one is to arouse the audience's internal information needs and thus generate information behavior; the second is to initiate audience to generate new information needs and conduct information behavior .

Process of information behavior

Information behavior is the audience's action and history to response and meet their information needs. "Information behavior" theory is interdisciplinary science formed in communication science and information science, which not only covers various elements of the analysis of the media, but also explains more systematically issues of the relationship between media and people. From the traditional information point of view, the domestic definition of audience's information behavior is that "mainly refers to human use their wisdom to start a variety of information activities which is a series of process of human information inquiries, collection, processing, production, use, dissemination and so on. " 【2】. Japanese scholars Mikami Shunji believe that information behavior is an action of personal in the social system to use the media or directly to the collection, transmission, storage information, and processing of information. Further more he also proposed the basic model of information behavior . 【3】

In science communication audience’s information behavior is mainly the process of produced and accepted scientific information. This article explore information behavior process based on the knowledge which is a typical representative of scientific information. The main way to accept knowledge is reading scientific literature, it is also a process of scientific information received 【4】. In our view, the four steps which is "reflect - select - Integration - internalized" is not only the interpretation of the process of accepting the scientific literature information, but also suit to explain the process of general acceptance of scientific knowledge. Scientific knowledge is the results of human reason and a kind of information whit processing and refining, also can guide people's practices. So knowledge acceptance generally emphasis on "understanding" and "internalized" these two steps. It should be noted that the "select" is not a separate step, but throughout the entire process of acceptance of scientific knowledge. Accepted scientific information can be summarized into three steps: reflecting - understanding - internalization. Reflecting is the perception and initial understanding of scientific information; understanding is to interpret scientific information and to grasp the essence of the thinking process; internalization is the process confirmed the original scientific information and the full acceptance after practice testing.

Effect factors of information behavior

From the perspective of information studies, many scholars have discussed the factors affecting information behavior: William J. Paisley summed up the eight-factor point of view focused on environmental factors 【5】; Abdelmajid Bouazza summary view of the three factors 【6】 focus on aspects of personal characteristics; C.L. Mick and George N. Lindsey 【7】focus on two aspects of personal qualities and interpersonal; Wilson's three-point 【8】 factors is in line with the actual situation including personal characteristics, interpersonal and environmental factors.

Social science theory said that "all human social behavior is under the influence of the social environment and through learning of model behavior to form, improve or change." 【9】 The critical factor of human behavior that person factors and environmental factors play a role not in isolation, but the result of the interaction between people and context. (Figure 1). 【10】

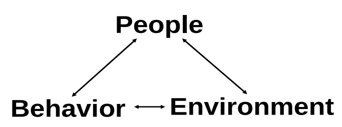

Figure 1. interactive relation

Behavior, human factors, environmental factors connected with each other and mutually decided to form a triangular interaction. From this point of view to analyze the factors which influence the audience’s information behavior to discuss three aspects including human factors, external environmental factors and the interaction between the both.

(1) The audience factors including physiological factors and psychological factors.

a, physiological factors, generally including height, gender, exercise capacity, health status, age, disease, mainly referring to people in the development and changes on the physiological functions. As the human cognitive ability, with the individual growth and progressive development, so that different age groups, often have different information behaviors.

b, psychological factors. In general, human behavior is impacted by cognitive, emotional, and emotion of three psychological processes. In these three areas, play a leading role in cognition, and mood and emotion, will, play a role in regulating the control. Therefore, the information of the acceptance of human behavior will affect the psychological factors are divided into two categories: cognitive patterns and mental state.

(2) Science Communication of the environmental factors. Different social role of a person have different information needs and impact different ways and content of information behavior. People not only have different social roles, but also have different social status, which determines the same information on the different attitudes and behavior acceptable.

The social environment factors, including three aspects: first, scientific information, which includes scientific information resource and scientific information characterization. A lot of rich information resources will consume audience energy of identification, selection and filtering and tend to audience to form mental fatigue, so it will reduce the effectiveness of science communication; and information resources are too scarce to make the audience produce disappointment and reduce the enthusiasm; reasonable representation of scientific information (such as information structure is reasonable and whether the information simple and eye-catching presentation) will affect the efficiency of using information. Second, the science communication activities. On the one hand, science communication activities as an information intermediary, provided the information source for the audience’s information behavior to promote the occurrence and development of information behavior; the other hand, the information content may be repeated processing in the process of science communication, it is different from the original source of the content, so the receiver of information have some impact. Third, technologies and tools in science communication. The use of information technology and tools to make the information behavior of the audience has undergone tremendous changes. For example, the rapid spread of the Internet today, people may not be through traditional ways and means of access to scientific information, but consciously search through the Internet to find the information they need.

(3) Interaction between the factors. We discuss the impact factors of audience’s information behavior of its own and external environmental factors. In fact, the two factors do not work in isolation, but intertwined, so this interaction also affects the audience's information behavior. For example, the mass media and audience interaction, on the one hand the mass media guide and control the audience’s information behavior, on the other hand the audience have a choice to accept the mass media impact of mass media.

Conclusion

In this paper, we carry out audience research of science communication in "information behavior" perspective, and utilize comprehensively psychology, communication, sociology and other disciplines theory in order to discuss the characteristics and classification of the audience and information behavior of the needs, processes and factors and other issues. This is the first attempt from an interdisciplinary perspective to explore the audience’s information behavior in science communication, on the basis of previous research, and focus on a number of levels from the theory of exploration and analysis. Audience’s information behavior of Science Communication is based on traditional information behavior research, so the basic theory of traditional information behavior still apply in science communication. However, with environment change, science and technology development, human’s information behavior is undergoing change, so the audience's information behavior of science communication has yet to be explored.

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Social Education Policy of the Beijing Regime of the Republic of China (1912-1928)

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The author discusses the social education policies of the Beijing Regime（1912-1928） of the Republic of China and the chain between the popular science and the change of culture. The popular science in social education policy was an important part of governmental education system. At first the charactor of traditional Chinese culture decided its goal and inclination in which S&T had been regarded as a tool for the rule of the upper class. After great president Yuan Shikai failed to crown himself as emperor, the old ruling culture was fully suspected and the 'new' S&T culture came out to challenge the old one. The '4th May 1919' movement to pretest the transfer of German concession to Japan really alerted the whole Chinese society that change based on the 'new' culture was desperately needed. The conclusion is that popular science was introduced to China a little reluctantly from the late year of Qing Dynasty to 4th May 1919. When it is proved that old culture was ineffective the Chinese would adopt a 'new' culture based on modern S&T. So the main stream of Chinese society at that time was tipically conservative.

S&T Culture Activities for Knowledge Based Industrial Society

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Abstract. Many countries, in the contemporary world, are putting forth their whole energy in promoting the development of science technology in an efficient way to enforce the countries' competitiveness. Among such of their efforts, one of the most significant phenomena is that their governments, universities and industries are making tremendous efforts to cultivate human resources in science technology. In Japan's case, during the second term of the Science Technology Policy, they invested heavily in four areas including biotechnology, communications, environmental engineering and nanotechnology/materials engineering, all of which have great impact in science, economy and society. Japan also celebrated four Nobel prizes laureates during the year 2000 to 2002 alone, resulting in boosting the morale of the manpower working in science & technology.

Moreover, cultivation of talented engineering manpower is one of the major tasks that the Japanese government intends to continuously pursue to achieve, and to make this happen, they are promoting establishment of the engineering education of superior quality through academic-industrial cooperation, cultivation of management of talented manpower and maintenance of various systems to recruit splendid foreign human materials.

Therefore, at the moment, it is important for us to know what we should do and how we can achieve our purposes in order for the promotion of knowledge based industry, which will be the potential power for future developments, and to establish proper policies and roadmaps so that the cooperation between the government, related authorities and manpower in the field shall be smooth.

Keywords: Education, Science and Technology culture

1

Geophysics on Stage: bringing Earth into Scene The INGV Science Theatre Experiences

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Abstract. Since September 2008, the National Institute of Geophysics and Volcanology in Rome has started to experiment science theatre as an innovative tool to promote seismic risk awareness and earth education. Up to now two projects have been implemented within the Science Popularization and Education Lab. The first one, more traditional, involving pupils of the primary school was devoted to promote seismic risk and earthquake education among children aged 6-8. The Sicilian "Colapesce" tale was rewritten and readapted to commemorate the 100 years from 1908 Messina Earthquake, to be performed in a school theatre by pupils (II and IV classes Scuola Primaria Federico Di Donato, Rome). It was as well an experiment of science without frontiers for the presence of schoolmates from different countries (Asia, Africa, South America, East Europe and Italy). The second was a pilot-project developed in collaboration with Ente Parco dei Castelli Romani and concerning the possibility to establish in the future an Ecomuseum in one of the Lazio Region areas rich of natural landscapes and history. The students of two classrooms of the Mancinelli and Falconi Institute in Velletri (III Classical Lyceum and III Socio-Pedagogical Lyceum), aged 16, chose an itinerary in the volcanic-origin area around the Nemi Lake to be developed in three items: the Roman Ships Museum; The lake itself; and the Diana Nemorensis Temple's ruins. The final goal was interpreting the territory with the help of scenic actions. It was a sort of opened-air theatre where history, legends and their historical figures - mainly Caligula and the Goddess Diana - described the area from the different points of view: geological, historical, naturalistic and even gastronomic. Both the projects have been evaluated, but in the second case, one of the two classrooms, being a Socio-Pedagogical Lyceum, was involved in the evaluation process under the supervision of INGV Didactic Lab. Results from both projects, and a comparison between the two will be shown.

The Uses of Drama as a Teaching Strategy

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Abstract. In the UK there has been a fundamental change of government policy towards teaching fact-based subjects, with a new impulse to free up the curriculum for more imaginative and cross-curriculum teaching–allowing 20% of teaching time to be at the discretion of the individual teacher.

The recent Government minister responsible for Education, Professor Hepple, has illustrated how this might be interpreted for science, through the subject of Climate in Crisis and the issue of sustainable growth, as this clearly connects with other subjects, such as Geography, History, Physics, Economics, Ecology and current affairs.

In this way, he believes that, at both school level and across all ages, the teaching of science should become:

- more appealing and interesting;
- more relevant to students' lives, connecting with the wider curriculum;
- more involving, participatory
- and more playful.

The following would, therefore, form the basis of my 20 minute paper to plenary and/or a one hour Workshop.

By taking key controversies behind the objective facts, for example (a) the benefits of the use of nuclear power for the generation of electricity versus the risks or (b) the issue of Designer Babies and the possibility of parents choosing the sex and characteristics for their children, I would explore a variety of approaches that could be applied to a range of students and abilities across the learning spectrum.

Furthermore, I would outline and exemplify a number of drama techniques that could be exploited as transferable teaching and learning strategies for a whole range of subjects within Science. These would include:

- ***Roleplay***–by taking a historical or significant contemporary figure in the scientific sphere, demonstrating that this does not involve 'acting' skills on the part of the trainer so much as the representation of the arguments and points-of-view of this figure.

- ***Hot-seating***–this is an extension of role-play, this is also a skill that can be exercised by the students as well as the trainer within the context of the learning situation.

- ***Simulation***–this involves the structuring of a more concerted project, for example for a whole year group over an extended period. This could entail more detailed engagement and research across the curriculum (eg. graphics and displays, History, and Geography etc.).

Please Note: As the workshop would engage the participants practically, and I would be illustrating the techniques employed, I suggest a maximum number of 25 for this session. Plus delegates would be provided with a simple hard-copy of information and a summary of the techniques used within the workshop.

Talking Science and Listening: Science Communication Training for Dialogue and Debate

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Discussants:
Toss Gascoigne (Econnect, Australia)
Kajsa-Stina Magnusson (ESConet, University College London)
Jenni Metcalfe (Econnect, Australia)
Declan Fahy (ESConet, American University, Washington D.C.)

Abstract. Demands on researchers to engage with their fellow citizens about their research, its importance and its implications, have never been greater. Yet still the majority of scientists get little, if any, training for these duties in the course of their professional education and development.

Over the past two years, the European Science Communication network (ESConet) has been engaged by the European Commission to train its network-funded researchers in science communication. Over the past few years, ESConet has developed a set of training modules that be used to deliver basic science communication workshops that involve writing press releases, being interviewed, and producing public science websites. In its advanced workshops, participants get to present to policy-makers, communicate about risk, and be part of public dialogue and engagement meetings. All of these modules are supported by sessions that introduce an idea of how the mass media cover scientific research, and the importance of social science for science communication, amongst other issues. The workshops have been underpinned by a commitment to dialogue-based approaches to science communication, drawing on the latest public engagement research–often carried out by network members–to continually link theory and practice.

Given the numbers of researchers throughout Europe, demand for such workshops is high to overwhelming. Over the past two years, in an almost production-line fashion, ESConet has delivered more than training 350 sessions in three-day workshops to some 250 of Europe's top researchers. This year alone, 150 would-be participants had to be turned down due to lack of places. Many participants made it clear that other members of their research networks wanted to be trained.

A similar need in Australia is filled by private companies operating on a commercial basis. The cost has not deterred research organisations and universities commissioning workshops, and in the past 18 years Econnect (through Jenni Metcalfe and Toss Gascoigne) has run about 800 workshops throughout Australia. The model they developed has proved to be transferable: to other presenters and to other countries.

Under a new science communication package to be instituted by the national Government, new ways of training scientists are planned. These could include on-line training modules.

This session will outline the experiences of trainers delivering these workshops and reflect on the feedback from trainees. The discussion will be an opportunity for those who have staged workshops in different cultural contexts to share their experiences.

Preparing Citizen Scientists: Engaging Through Interactive Media

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Abstract. Use of interactive multi-media is underdeveloped in science among university science students, our future citizen scientists. They will need to produce, evaluate, and critically examine science communication in various modes of interactive media: podcasts, blogs, video, social networking, and internet platforms. We invite conference delegates to discuss how one can teach future scientists to create and interact with others via such “new media”. Our session explores the new skills and insights necessary for scientists who will use these media to engage with scientists and nonscientists as well as the training and research that the field of science communication can offer.

Keywords: Interactive media, Blog, Video, Podcast

Introduction

Despite the truism that the internet is now integrated with modern life in many parts of the globe, there is substantial evidence suggesting that its potential for engagement is underdeveloped. Even among ardent users, such as university students, the interactive features of media remain underexplored. In the sciences at universities, future researchers as well as tomorrow’s scientifically literate citizens express an interest in using interactive media (blogs, podcasts, digital video, social networking) to communicate about science, but they are often unsure how to go about it.

Curricula in science communication and in STEM (science, technology, engineering, and mathematics) disciplines have not as yet embraced interactive technology as a topic of teaching, training, or assessment.

We have undertaken a project to explore examples of the use of interactive media to engage students in learning and critical assessment of science and technology. The aim is to produce teaching materials, train lecturers, and evaluate the impact of our materials on student learning. We also seek to develop their ability to critically examine science communication via podcasts, blogs, digital video, social networking, and internet platforms for publishing.

Examples of Science in Interactive Media

The world of science increasingly demands professionals who can represent themselves, their organization, or their cause not only in person and on paper but online. These new technologies provide opportunities for reaching broad audiences, with the added facility for interactivity. One can potentially stimulate dialogue involving scientists, science communicators, and stakeholders ranging from villagers to highly placed government officials.

Scientists are increasingly sharing via blogs and open, electronic, laboratory notebooks. Laboratories post podcasts or enter competitions to see who has the best website or most engaging animation of a scientific process. Doctoral students place videos on *You Tube* that depict interpretive dances that present their dissertation topics.

Teenagers can follow the *Twitter* feed of a famous inventor or science fans watch the video of a *TED* lecture by an accomplished researcher. Citizens can contribute to debate on climate change but can also provide data. They can use their mobile phones to create videotapes depicting instances of environmental pollution or illegal logging. Smart phone apps can register sightings of animals from endangered species. Strategies for prompting action by local government can be shared on blogs and wikis, alerting “fellow travelers” via feeds on *Twitter* and RSS.

Opportunities for use of such media are easy to conjure, but some sense needs to be made of where things are likely to go and what role science communicators can play in these developments.

How Does One Engage Our Future Citizen Scientists With Interactive Media?

How have university students been contributing to scientific understanding through use of such media? Who are their audiences -- local residents, students elsewhere in the world? How successful have these exercises been? We will share insights from a small group of university science lecturers in Australia who assign their students to create interactive media.

What New and Old Skills are Necessary for Engagement Through Interactive Media?

Determining the aims of a communication effort, analysing the audience, developing suitable strategies, and assessing impact are all familiar undertakings for a science communicator. However, each of these processes changes when one ventures into interactive media.

Some audience segments use these media, and others are left out. As a result, strategies for communicating should accommodate.

The fact that the media are interactive can ease the process of assessing one’s impact, but it can also become more difficult because measures are changing. For example, distribution of 10,000 fliers may be considered less successful than having 10,000 web visitors who remain for 30 seconds or longer, even if only 250 leave comments.

We must reconsider how we teach students to present science, assess the impact of their messages, and respond to replies.

What Training and Research on Use of These Interactive Media Can the Field of Science Communication Offer?

How many of us provide training in use of interactive media–from workshops on creating a web page to guidelines on blogging of science or courses in how to make videos with one’s digital camera? Every science communication degree program in our country has its students learn how to create interactive media. How extensive is this training across institutions elsewhere, and to what extent is it reaching into core science curricula? How is training supported by research on the impact of online communication and dialogue strategies?

As our field is ripe for addressing how future scientists might effectively engage with others through new media, notes on what is said in our session–and ongoing dialogue–will be shared online after the conference at http://newmediaforscience-research.wikispaces.com.

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Evolution of the Public Understanding of Science in Spain in the First Decade of the 21st Century

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Abstract. In Spain, the Spanish Foundation for Science and Technology (FECYT), a body attached to the Ministry of Science and Innovation, has been carrying out a bi-annual survey on the public perception of science since 2002. The survey has been carried out in five waves (2002, 2004, 2006, 2008 and May 2010), with a steady base group of questions to guarantee comparability. The study is structured around three major blocks – interest in and information about science and technology, the social image of science and technology, and public policies to support science. Aside from serving as a thermometer to give a read-out of the level of interest in and appreciation of science and scientific activity, the study also acts to guide the Ministry of Science and Innovation in developing policies to close the gap between science and innovation and the public, identifying strengths and weaknesses, as well as target stakeholders upon, for example young people and people living in medium-sized and small towns and certain regions.

Keywords: public understanding of science, Surveys, Social perception, RTD public policies, Social image of science, indicators, Spain

Science Communication through Science Fiction: Opportunities, Challenges and Perils

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Communication without frontiers–the theme of this meet–be it science or any other area of human endeavor, is an appealing and engaging idea. While science fiction (SF) is mainly about going beyond frontiers, is about the spaces unexplored, science communication is about communicating concepts from science as we know it today. Science communication has to be about hard facts, proven concepts and theories. In the Indian context, science communication is mainly about making science and a scientific culture penetrate the socio-culturally diverse society with a view to transform it into a nation of scientifically aware people.

We need to understand that good SF is exploratory, futuristic and extrapolative in nature; it is a rich medium that discusses technological innovations, possibilities and perils; it holds all the potential for engaging and inspiring young minds; its 'thought experiments' trigger a young mind to think beyond the immediate; and above all, its interdisciplinary nature lends it the potential to be used as a tool in teaching different subjects. All these mean that science fiction is not mainly about science communication.

While SF provides the largest and the most flexible space for debates on alternate histories and futures, does it really give us a space to talk about scientific innovations as they exist today? Are we getting into the danger of mixing up science with something fictional and imaginative? What possibilities, opportunities, challenges exist when we take science communication and science fiction in the same breath? The proposed paper addresses these questions. It attempts to come up with a few guidelines to follow while using SF as a tool for science communication.

Science Communication Through Entertainment Media (In the Context of Science Fictional Films, Documentaries & TV Shows)

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Abstract. During the past several decades, science and media both changes time to time. From past till now science has become more bureaucratic, problem-based, and dependent on private funding. Media also change their coverage importance. In present only entertainment media continuously work on science based issue. In fact in last 2-3 years film industry more focused in science & fictions in comparison of other type of media.

Most costly James Cameron's film (1200 crore) AVATAR, Bollywood most costly (190 crore) S. Shankar's film ROBOT & one of the successful film 3 idiots are live example of the importance of science in entertainment media. All the directors & actors of these films also accept that entertainment media is the power full tool to communicate & explain science in easier way. Rajnikant (lead hero of ROBOT) also said that entertainment media has more potential to teach Hands On Science.

In foreign countries also entertainment is the best option to communicate science in mass. In maximum places colleges & educational institutions offered "Science and Entertainment Media" courses. It explores the structure, meanings, and implications of science communication through entertainment media by reading scholarly research and critically analysing media texts.

Hypothesis: Entertainment media (Specially film industry) are more aware to communicate science as a knowledge based entertainment. Changes in science communication are needed to better engage the public on science-related issues. In present the development of science calls for more discussion between all type of media & viewers-readers. It also exerts pressure on film makers and media houses to provide proper space for science journalism.

Methodology: Interview with stake holders of media and film makers. Content analysis of available reports & science based films.

Can Science Education be Made a Joy? The Answer is Scientoonics

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Science education is facing now-a-days a tough challenge around the world. Many times, the way it is being taught, it looks very technical, less interesting and sometimes even boring. Educationists around the world including in USA are worried as students are opting for more lucrative career options in business, commerce and information technology. This trend is not a healthy one as no country can progress without the development in science. Similarly scientific presentations in the conferences/ seminars/ workshops many times are quite boring because of the poor presentation.

Scientoonics is new branch of science, which deals with effective science communication using a novel class of science cartoons called scientoons. Scientoons are a new class of science cartoons, based on science. They not only make you smile and laugh but also provide information about new researches, subjects and concepts in a simple, understandable and interesting way. It is well said that a picture is worth thousand words. Cartoons are the combination of caricature and satire. Caricature means distorted drawing and satire means a humorous comment. If the subject of the cartoon is science then they are called science cartoons. Scientoons have been recognized/appreciated all over the world by several international organizations including WHO, UNESCO, UNEP, Royal Swedish Academy, International Union of Pure and Applied Chemistry, American Chemical Society, Junior Chamber International (USA), DECHEMA, Germany, European Science Festival 2008 and also by NCSTC (DST, Govt. of India), CSIR, Indian Science Congress Association and many more.

This Scientoon based audiovisual technique is more useful when a scientific program is undertaken for mass awareness on the subjects like environmental pollution, biodiversity conservation, Nanotechnology, DNA Technology and Human Genome, AIDS awareness and many other subjects and areas. This paper is an attempt to show that how complex subjects of science can be presented and effectively explained using scientoons so that the science communication/education can be made more informative, effective, interesting and useful. A live demonstration will also be give as how to learn to draw the scientoons.

Science comics in India as a pedagogical medium: A foresight

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Abstract. Contemporary science comics in India seem to be underdeveloped and rarely cater to the changing view of science-as-a-career by the Indian urbanites. The colonial tradition of newspaper cartoons in attacking science has not been carried forth and is tainted by the disconnect of an Indian Renaissance.

Towards cultivating a cartoonist's perspective to making science comics achieve a cult following, a persuasive call to investigate hidden science in folk comics and international syndicated cartoon strips is made.

While political actors find a niche backing or thrashing in comics, scientists rarely have a share in the ideology of the daily funnies and stereotypes abound unfairly and decry a no-say in their internationally marketed image.

Keywords: Contemporary science comics, Folk science in comics, Renaissance of Indian science

Introduction

Comics can help in promoting science literacy and encourage scientific dialogues. As a mass medium it supplements other modes of dissemination and engages the public in a unique way. As a pedagogical tool, comics can not only pass scientific facts, but also inculcate the mode of scientific thinking through a sustained rational narrative. Comics have been widely used internationally to discuss issues regarding scientific ethics and provide psychological support to ill patients by acting as counselors. Science comics have become a prominent genre crossing national boundaries. Translations of comics made in other countries are to be undertaken to be open to contrasting global views on scientific perspective and policy making.

Interest in comics as a two way dialogue can be enhanced through forums on the Internet, where children can speak out for their favorite characters. Comics can easily provide visibility to behind-the-scenes of publicly used scientific products like weather forecasts, dispelling myths and stereotypes that ail the scientific community. Comics can also lead to generation of strange ideas via its low profile and easily accessible take on scientific humor

In India, specifically, great science comics are rare and hard to come by. Indigenously created science comics like Scientoons and Young Scientists magazine are limited in their scope for exposition. A comics culture that appeals to the youth of India, that draws them to a reciprocating career in science is found wanting. Comics can promote the various careers on hold in science or can look at the history of the institutions of science that came about in India as different from those around the world.

In the traditional knowledge economy, beyond the usual research, development and individualized innovation model, communication is the recent catalyst introduced in the last decade that enables science to mix well in a solvent society. Beyond respecting our rich heritage, resources, wildlife and diversity and defending our country patriotically through serving the nation and promoting harmony that transcends religion, language, geography and gender, it is the fundamental duty of every Indian citizen to develop the scientific temper, humanism and the spirit of inquiry and reform (as said in Article 51(A) of the Indian Constitution). I thereby wish to herald comics as a melting pot where interdisciplinarity can be explored with a comic license, focusing on reducing the gap between the two cultures, converging science and humanity.

Science comics–What are they?

Science comics are usually an intersection of science fiction and sequential art. Sequential art differs from a movie or video in the way that static frames are spread out spatially. Similar to how movies have become ubiquitously 3-D, recent futuristic comics in the digital medium try to ensnare this effect via frames drawn with parallax kept in mind. New media constantly rediscovers and refines what is paradigmatic as a comic.

Science comics can be broadly defined as any comic that has scientific content (Fig 1 and 2.). A survey of recent science comics of repute has been underwritten by Tatalovic in [6,7]. Additionally of interest in the realm of science is the science of comics, especially where the world of 2-dimensional visuals with explicit gutter as planned by the graphiateur switches over to the 3D world of minutiae as portrayed through animation. The anticipation of motion is implicit in the framing of the scene using *la ligne contour* and *la ligne expression.* Our ability to understand and synthesise this gestural dynamism is a profound area of investigation in visual sciences.

Additionally the biological affect of comics also plays in what makes a comic character endearing. Stephen Jay Gould, the evolutionary biologist, charted the neoteny in the evolution of the Mickey Mouse sketches as the most recent redrawings encapsulate the protruding forehead and retracting jaw of the infantile and inculpable. Hence science in comics can extrapolate very far.

Figure 1. A plausible science comic from syndicated cartoon strip *'Pardon my Planet'*

3. Digging the historical archives for science cartoons

Historically, during the industrial revolution, comics and caricatures seemed to be of great importance in the debate on scientific facts and their interpretation in geology and evolution with the poster boy of this era being the derogatory, but scientifically true, caricature of Darwin as an ascent from primordial life. [2, 3, 5]. 'Evolution: A journal of Nature was prominent for airing teachers' troubles in curricularising evolution while weathering creationist pressures through cartoons (Fig 3a. and 3b.)

Comics as opposed to other cultural artefacts escaped from a sustained exhibitionary culture, and have been dominated by the motion picture industry in India. While the National Council of Science Museums has a very successful network of institutions and galleries that popularise science to the public, it seems there is no programme under the aegis of NCSM to specifically promote the visual culture of science in India and science comics in particular. In recent times the institutionalisation of this movement of preserving the comic culture has been spearheaded by Indian Institute of Cartoonists at Bangalore. Even in major mobile science exhibitons on wheels like the Science Express, there has been a grave neglect of this art form.

Figure 2. Captioned - "Dashed long way to come, but at least we can have a Test Match up here without it being ruined by their wretched Earth weather." – A cartoon by Joseph Lee from British Cartoon Archive.

Rarely, plausible scientific explanations of myths from the Indian epics like the Mahabharatha find a huge audience [5]. Even the superhero culture of heroes like Superman are constantly scrutinized for scientific standing. China in comparision to India has a very robust science fiction industry and the lack of Indian science fiction attributes towards a poor representation in scientific visual editorials.

Afraid of his own shadow

ANOTHER FAMILY ROW
From Chicago Tribune, Dec. 1.

Figure 3a and 3b. Comics that fuelled the scientific and religious climate during the famous Scopes trial of 1925.

Investigating the Role of a Scientist Through Comics

Due to an increasing number of natural epidemics and catastrophies and a medialogical turn towards accountability of intellectualism the scientist is harboured with as much responsibility as a politician when the standard of life is threatened at national scales. The stereotypes portrayed in the media of the rarely represented scientist is often misleading and magnanimously uncritical. In an era of post academic science when innovation through rationality and design is a commodity, the corporate enterprise of science is defiant to mediation. Often the idea of a lay scientist seems to camouflage itself to the utopian Mertonian norms (CUDOS - ‘communism’,‘universality’, ‘disinterestedness’, and ‘organised scepticism’), whereas in spite of a marked movement to open source and open access, industrialised science follows the Zimanian norms (PLACE - ‘proprietary’, ‘local’, ‘authority’, ‘commissioned’, and ‘expert’)

The famous cartoon strip ‘Dilbert’ was famous for addressing the cynicism about organization and management and the mentality to flee from organizationally based careers [4]. As the constitution of a scientific aspiration changes the current day scientists need a comic scaffold to alert them about the nature of scientific endeavour. Famous international rivalries among scientists are staunch fodder for comic artists and it is the duty of cartoonists to deride the spectres of plagiarism and other co-morbidities that spell death to a scientific rationale.

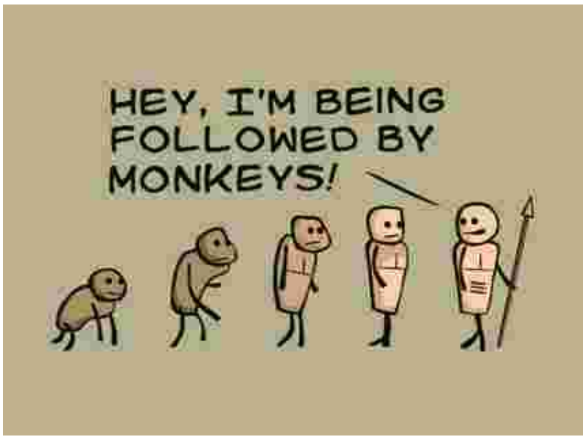

Figure 4. A simple comic representing evolution. Note the evolution of the faculty of speech and the ability for abstraction.

Visual Culture of Science in India

The talk about visual culture is often decommissioned by scientists who hold a shoot-at-sight complacency towards their postmodernist peers of other careers. However this visual culture needs to be first created and then curated nevertheless.

Through comics one could wish to rhetoricise the approach of science towards the discourse of the curator. What do scientists preserve? Can they afford to neglect a 'law' of Nature as opposed to an artist's framing of reality in a medium? Without putting in a sampling of imperfect scientific apparatus and the apparatus of imperfect science as a doorstopper, I fear the halls of visual culture would be alienated from the invisible allegations of scientific materiality and imperialism. Would scientists professionally inspire archiving the frailties and frivolities of their discourse. How do scientists immunise the veneration of the random and the ugly. While the artists embowel themselves on the sceptre of perception and illusion, the scientist corrupts nervous gimmicks around the gaze of brain teasers. In the aggressive panopticism of frontier science, hoaxes and misconducts are relayed into a paradigmatic half life. However there are not luminary vigilantes who sniff out and confront a trafficking of artistic misconduct, and nor are wars waged to neutralise weapons of drunken mass deconstruction. What, as a curatorial embellishment would a scientist tattoo on the rational animalistic hide he/she has slipped into? Comics lies at the interface of the science / art two culture debate and it hence assumes an imperial role in negotiating crossfire.

In the fall of heroism following the post-modernist's relativizing of truth and hence dismissal of an anchor to standards that guide humanistic choices, comics can cater to opinions of lifestyle abandoning the typical superhero and questioning of authority [Fig 5, 6 and 7].

While I wish to portend an immediacy of science comics in India, let me not forget that there is a huge vacuum of allied visual cultures in other societal disciplines like law for instance. While several campaigns for grassroot comics have sprouted in various communities it is of essence that academics take to the *jeu d'esprit* of comic denotation and hence forward an indigenous Indian directive towards the melting pot if international comics. The temperament of the comic is as much of a brand that serves as a geographical indicator of the territorial fame and hence only stands to accrue economic remuneration.

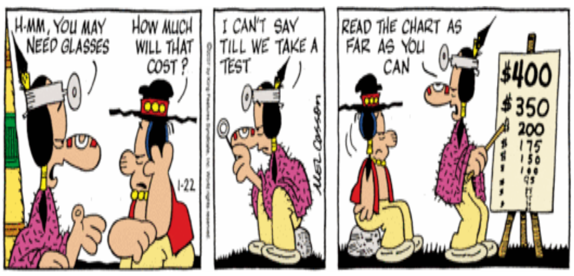

Figure 5. An attempt at humor in optometry

Figure 6. An awareness comic on obesity from *'Pardon my Planet'*

Figure 7. An example of scientific rhetoric via a comic.

Acknowledgements

I acknowledge several syndicate cartoonists and graphic artists who have provided a lot of free graphic content on the web. I reproduce their cartoons here under a creative commons license.

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Effectiveness of Animated Science Cartoon Among Lay Audience and Educated People–A Case Study

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Abstract. Objectives of science communication are popularization of science for the developing countries like India and stimulation of scientific temper among people .We can spread awareness among people about scientific aspects of events, happenings, and natural phenomena and about scientific principles around us in daily life. Animated science cartoons are new arrival and more attractive and impressive nowadays. Science related issues can be easily communicated to the people in the form of animated science cartoons. It is an entertainment to the people without making them aware of the fact that they are under the trail of science communication. Animated science cartoon is a wonderful tool for explaining and high lighting various Scientific, Environmental concepts and Problems among all levels of people. This form of science communication, explains complex science subjects in easily understandable way because it is novel and enjoyable one. Visual images communicate more readily to the people than other media. Animated science cartoons carries information about new research, subject or data message or concept in a simple lucid and comprehensible manner to the lay audience. It attracts your attention towards a problem in a thought provoking and interesting way.

If TV cartoon are shown with science message, children will surely learn development in science and technology with more interest. Animated e- book can also be prepared with text, audio, video and animated movies. If the dry text books are converted into animated e-book and the concepts are explained through the animated cartoon characters such as Boojho and Paheli, Vikramaditan and Vedalam, Tom and Jerry, Paramathaguru and his disciples, etc., the children will certainly learn with more interest. Even knowledge on social issues like health and hygienie, environmental issues, etc. can be imparted to the common man through animated science cartoons with the popular characters among the people.

Methodology to develop animated science cartoon is to identify the science and technological issues which are directly related to the targeted audience and the animated science cartoons are developed in regional language. Animated science cartoons which are in the form of CD are portable, take up less space. It can be distributed anywhere. It is an interactive form and contains text, pictures, audio, video and animations which enhance the message that the science communicator is trying to convey. The main features are readability, usability, availability, portability, changeability and multimedia capability. It can be easily modified and updated.

List of animations taken for the case study are

1. Evil effect of smoking–It creates awareness among the people that smoking is injurious to health and create cancer problem. Feedback is received from the college students, youths and common man
2. Cleanliness and hygiene through Paramathaguru–Feedback received from school children, women's self help groups, paramedical students and B. Ed students
3. Global warming issues–Feedback received from Engineering College students.
4. Advancements in Science and Technology through Vikramaditan and Vedalam character–Feedback received from Engineering college students and common man
5. Natural calamities–An over view–feedback received from Common man
6. Thirukkural and science–Feedback received from school children and Arts College students.

Conclusion: Animated Science cartoon movies are thus an extremely popular visual medium that use an artistically simplistic style to communicate deep seated cultural assumptions and scientific thoughts and therefore Animated cartoons of science are an ideal source for analyzing popular image of science. Animated science cartoon is thus one form of science communication sandwiched between the slices of entertainment can rightly harvest people's attention. This approach is more accessible to less educated people, youth and Children. This would spread right down to the village level too. Animated science cartoon has the potential to serve both ends, a science communicators as well as common man almost with equal weightage.

Cartoon as a Tool for Science Communication

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Abstract. Scientific experiments are carried out to gain better knowledge and understanding in that particular field. The efforts of such scientific inquiry need to be disseminated to the common man to use this knowledge for better and safe living. It is only then that the common man is benefited. There are different ways to achieve this. Scientific communication needs to be made simple and attractive. Cartoons are one such tool that can be used in attracting and retaining human attention on matters of scientific importance. Cartoons are a universal medium; hence the task of translating science into local languages is made easy. Cartoons are self explanatory and the barriers of language and illiteracy are taken care of. Cartoons educate and entertain at the same time. They are very effective tools of 'edutainment'. It helps in creating awareness leading to discussion, debate and implementation.

'Sciencetoons' are cartoons based on science. They provide information about new researches and concepts in an interesting and effective manner with scientific principles.
Today people prefer instant messages and cartoons are powerful and effective instant tools for science communication. Cartoons convey messages with wit and humour making the topic interesting and thought provoking. This would further instigate a scientific temperament leading to scientific inquisition.

Climate change is a major concern of humanity today. Cartoons can be used to senstise this matter of grave concern.

Figure 1: Look at the excitement of the shark as it reads about the sea-level rise in the newspaper! It is sharing it's excitement to another shark to be able to swim near to the island and eat up the man who is fishing. This cartoon brings out the dangers of sea level rise.

Figure 1

The sea level rise is not merely due the melting of polar ice and glaciers adding extra water to the seas. It is also because the sea water is expanding as it heats up. This could mean total disaster for many islands and coastal areas, especially river delta areas. Sea level rise is a phenomenon that has occurred due to climate change.

Figure 2: Local stories inspired this cartoon yet it's a problem everywhere. The lack of available land to build houses on compels people to build homes on flood plains... which, of course, occasionally flood. Invariably, the lawsuits start flying.

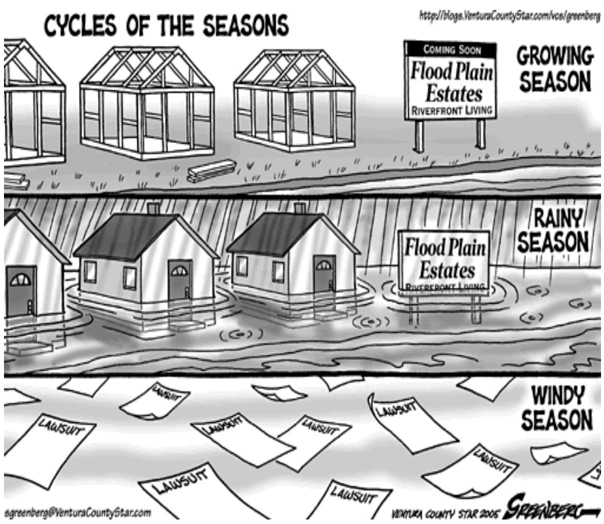

Figure 2

All these cartoons highlight the apprehension both at the universal and local level and hence can direct towards enhancing scientific temperament. This paper examines the use of cartoons in creating awareness and disseminating scientific information for a better and healthier tomorrow by undertaking a discourse analysis of cartoons published in newspapers as well as those posted on the internet.

University to the City: Science Goes Out

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Abstract. In today's society, scientific and technical knowledge is present in most of the acts and activities of everyday life. However, the diffusion and the overall level of knowledge run at a slower rate than production. Science and technology are integral elements of the culture of individuals and societies and as such his attention. The studies and surveys on Social Perception of Science and Technology show that the degree of public interest in this kind of issues is high but not the degree of information received signal. Scientific and technical issues, their consequences, risks and benefits are issues on which society wants to be better informed to participate.

Science and technology must become more familiar to the public. It is therefore necessary to strengthen its presence in the areas not only formal but also informal spheres. That is why the research group on dissemination of knowledge established in the Faculty of Education and Humanities of Melilla (Universidad de Granada) under the research project "Towards a Knowledge Society and Information, Public Dissemination of Knowledge in the Autonomous City of Melilla" funded by the Research has been conducting since 2004, in favor of disclosure not only of science and technology, but knowledge in general, a series of activities under title "Dissemination of Knowledge Week."

This activity, carried out regularly to coincide with the celebration of the European Week of Science and Technology during the month of November, is intended as a communication channel between knowledge and society, in particular among university as a core source of knowledge and the society in which the center is built trying to sensitize the population on those aspects of knowledge and in particular of Science and Technology, which affect their daily lives and increase scientific culture of citizens.

In this paper we present this initiative, science and citizenship. Show activities in each of the Knowledge Dissemination Weeks that have been made since 2004, such as activities (workshops, exhibitions, conferences, roundtables, radio and television talk shows, etc). This is aimed at all audiences, from school children, the first stages of education to adults and the general public, as well as a means to develop them. Highlight the close collaboration between universities and the media with the understanding that both should work hand-in-hand in order to provide the public with reliable and relevant information. Each November knowledge in general, and Science and Technology in particular, developed by the University are carried into the city so informative. Citizens unite and enjoy science in a readable but rigorous fashion.

Role of Demonstrations for Effective Communication Of Chemistry and Green Chemistry Concepts

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Abstract. The demonstrations are widely accepted as complementary tools for science communication. With the progress of time and technology the use and mode of demonstrations have also been modified. Modern cognitive science research reveals the requirement of student's active role for better perception of conceptual learning. Strategically this can be achieved more effectively in an atmosphere in which ideas are openly generated, debated and tested through demonstration experiment. Both the laboratory experiences and demonstrations are found to activate student's interest for initiation & perception of learning. This paper will provide an overview of the role of chemical demonstration experiments for conceptual learning of chemistry as well as green chemistry.

Keywords: Chemical demonstration, Cognitive science, Conceptual learning, Green chemistry experiments

Introduction

Most of the chemistry teachers in particular and science teachers in general, feel the need of demonstration as an effective and complementary tool of communication for conceptual learning. Because of its wide acceptance nowadays science demonstrations techniques are used for the betterment of teaching learning processes. Starting from 1950 the mode of science demonstrations became more popular teaching strategy. With the progress of time and technology, especially in the era of information & communication technology, the use and mode of demonstrations have also been modified and proliferated[1]. According to the modern cognitive science research student's active role is vital and learner's mind must be engaged effectively for better perception & transformation of conceptual learning. In this relation lectures and instructions alone are not sufficient to promote conceptual learning[2]. N. W. Rakeswtraw[3] rightly stated that the ultimate object is the ability to think abstractly and this can be attained only by learning to think correctly. No teacher can hope to instill enthusiasm of understanding into the learner by merely talking about the chemistry, without actually showing the processes and materials i.e. demonstration. At the same time to achieve more understanding, greater concreteness in teaching strategies and in instructional materials are also inevitable[4]. Beside demonstrations laboratory classes play a vital role in learning chemistry, even though demonstration experiments are very important for growing interest and also for proper perception and accumulation of conceptual learning. Both the laboratory experiences and demonstrations are found to be the powerful tools for activating student's interests and focusing their attention for initiation of learning and perception of conceptual learning of chemistry and green chemistry. Chemical demonstrations can also be used complementary tools, where practical class works are not possible. It can allow the students at least to see the experiments, which they otherwise would not be able to share. So the challenge of chemistry teachers is to attract and engage the active and visual learners by the use of well planned and effectively presented classroom demonstrations.

On the other hand green chemistry [i.e., design of chemical products and processes that reduce or eliminate the generation of hazardous substances] become an essential part of modern chemistry. But very little educational researches are found to promote the demonstrations for effective communications on green chemistry education. Although some reports on chemistry demonstrations workshops with educators are repoted[5-6]. The concept of learning with demonstration can also be applied for effective learning of green chemistry using green chemistry concepts, principles & experiments. Demonstration experiments based on green chemistry concepts and practices can provide pedagogical benefits to cope with the contents of greener curriculum [i.e., with the practical advantages of improved safety & reduced hazard]. Participatory demonstration of simple green chemistry experiments showed great impact on learner with the advantages of stimulating to find new/similar experiments to replace the existing hazardous one by them[7]. So the development of demonstration experiments based on green chemistry principles and practices for green chemistry communications are inevitable. This in-tern will definitely help to cope with greener curriculum of modern chemistry for sustainable development [reduction of adverse consequences of the substances/ chemicals/ techniques that we use or generate] of future world. This paper will provide an overview of the role of chemical demonstration experiments for conceptual learning of chemistry as well as green chemistry. Basis of selecting/choosing right kind of demonstration to prepare and conduct the same will also be attempted with critical analysis of some selective chemistry and green chemistry experiments.

Demonstration & Conceptual Learning

The primary job of a teacher is to generate and evolve the proper resolution of cognitive conflicts among the learners. Strategically this can be achieved more effectively in an atmosphere in which ideas are openly generated, debated and tested through demonstration experiment, either in lecture demonstration or in laboratory demonstration. Textbooks alone are not sufficient to develop a personalize understanding of concepts. Interesting demonstration can create links between previous knowledge and new concepts of learning among the students[8]. Chemical concepts may developed by analysis of experimental observation and careful reasoning. Series of observations and logical deductions will motivate learners to questioning to understand and reconstruct the concepts through discovery mode. Observing a new experiment/ demonstration/ incident definitely motivates and prompts student to ask questions with reasoned responses and finally to investigate & to draw conclusions that explain the foregoing observations. All these in-tern will enhance the cognitive skill of critical and analytical thinking followed by evaluation and synthesis, which is most essential to success in chemical sciences.

Different kinds of strategic demonstrations can be used with proper judgment and according to the need of the both of students and topics. (a) Classroom demonstration (syllabus oriented concept development) with the help of actual performing the demonstration experiment before the students. (b) Popular demonstration experiments with hands-on activity using easily available & inexpensive materials and active participation of students. (c) Magical demonstration to explore myths and mysteries of incidents. (d) Virtual demonstration with the aid of computer animations and video presentation[9-10], etc. Choice of right kind of demonstration largely depends on targeted audience, teacher's skill and relevance with suitable concepts or topics.

Comprehensive Planning

The Demonstrations of all levels to communicate effectively should be of well planned to attract and engage the active and visual learners in modern classrooms. Success in effective communication largely depends on proper planning and choices of strategic type and/or proper blending of many types of demonstrations. Basic components of a good demonstration are;

(i) Complete, accurate instructions with purpose/ objectives,
(ii) List of equipments and materials with convenient sources for all,
(iii) Brief explanations of the concepts of chemistry & green chemistry involved,
(iv) Short description of stepwise demonstration procedure in simple languages, and
(v) Post demonstration works.

Steps for individual demonstration:

STEP-1:
Instruction sheet get ready with the following points;

Title of Demonstration,
Clearly stated academic purpose/objectives,
Foundation/previous knowledge review to be required to link students' past experiences,
Explanation of the concepts of chemistry & green chemistry involved,
Materials and Equipments required,
Times required,
Short Introduction on Demonstration/ Experiment,
Presentation procedure,
Post demonstration testing and Conclusions.

STEP-2:
Procurement of Materials and Equipments; Mostly with the help of students and should be of inexpensive, easily available, popular/known and eco-friendly.

STEP-3:
Foundation of presentation;
Discussion of previous knowledge is required with short introduction that connect the demonstration to the previous knowledge attracting students attention for careful observations and questioning[11].

STEP-4:
Performing the actual demonstration; The teacher will perform the demonstration with active participation of the students. Materials/incidents/happenings are to be properly observed by students. Involving students in hands-on activity will encourage students for timely questioning to understand the incidents through immediate feedback/discussions with peers and or instructors, i.e., active learning.
STEP-5:
Concept development;
Series of observations and logical deduction will automatically lead the students for further questions with reasoned responses. Teacher will assist the learners to construct and reconstruct the concepts through discovery mode.

STEP-6:
Post demonstration Evaluation;
Allowing the students to test and reconstruct their new knowledgebase/ understanding with new examples/evidences/incidents and helping them for appropriate understanding of corresponding concepts.

Sample Tested Demonstrations:

Demo–I: Flame Tests Using Common Household Materials[12]

Objectives:
The academic purpose of this demonstration is to identify elements from color emitting materials.
Foundation:
Salts, ions, elements, color flames, etc.
Concepts:
Elemental identification based on color flame.
Materials:
Common house hold materials.

For Boron; 2 tsp boric acid (H_3BO_3) and 1/2 cup of 91% isopropyl alcohol (C_3H_8O) are mixed.

For Sodium; Equal amounts of 70% isopropyl alcohol (C_3H_8O) and water are mixed and then saturated with baking soda ($NaHCO_3$).

For Potassium; Equal amounts of 70% isopropyl alcohol (C_3H_8O) and water are mixed and then saturated with cream of tartar ($KC_4H_5O_6$) followed by addition of 1 Tbsp of vinegar.

For Calcium; Equal amounts of 70% isopropyl alcohol (C_3H_8O) and water are mixed and get saturated with deicer ($CaCl_2$).

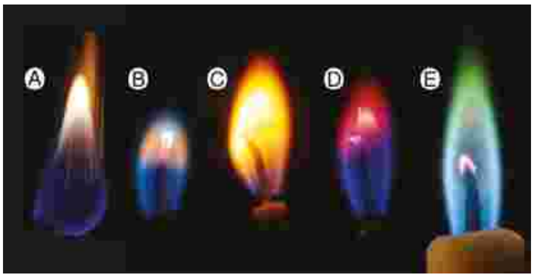
For Copper; 1 cup of ammonia and 1gm copper sulphate are mixed & shaken for 1 min, until solution turns blue. Then added one part blue solution to two parts 70% isopropyl alcohol (C_3H_8O). Etc.

Demonstration Experiments:

Household materials in mixtures of water and isopropyl alcohol are dissolved and the resulting solution is poured into a spray bottle. When the solution is sprayed as a very fine mist onto a flame generated by a wind-resistant grill lighter, a large flame is produced. The flame color depends upon the element present in the household item dissolved in the isopropyl alcohol – water mixture. Students are instructed to color in box of the element [in the periodic table] with the color of the flame observed.

Post demonstration Work:

In the post demonstration part students can easily find the possible element used in Colored Flamed Birthday Candles too.



(A) Isopropyl alcohol and water (B) cesium; (C) Sodium; (D) lithium; and (E) copper.

Demo–II: Determination of the Formula of a Hydrate: A Greener Alternative[13].

Objectives:
Academic purpose is to explain the principles of stoichiometry and gravimetric analysis.
Foundation:
Constant weight, water of crystallization, formula of salt hydrate, etc. are to be discussed.
Concepts:
Gravimetric Analysis;
Stoichiometry.
Materials:
Copper hydrate salts [Copper(II) Chloride dihydrate], Air-Oven, etc.

Demonstration Experiments:

The determination of the formula of a hydrate is an experiment that introduces students to many fundamental chemical concepts including stoichiometry, the notion of a mole and nomenclature. Copper salts are being used because they are less toxic, less expensive, and recyclable and produce vivid color changes (blue to brown) during the experiment. Not only are students exposed to the concept of environmentally responsible chemistry, but are asked to determine the formula of a copper chloride hydrate salt by measuring the change in mass after water is evaporated from the sample. The lab is also made safer by dehydrating the copper salt using an air-oven instead of individual Bunsen burners. We utilize a copper hydrate salt that shows both a visual color change upon dehydration and ease of rehydration upon exposure to steam.

Post demonstration Work:

Students are asked to calculate amount of water present per mole of experimental salt hydrate from the weight loss data, after getting constant weight. They will also report the gradual color changes. Finally teacher will assist them to find out the formula of a salt hydrate.

Demo–III: The Friedel-Crafts Reaction: Acetylation of Ferrocene[7,14].

Objectives: Acetylation of ferrocene with a green alternative pathway.

Foundation: Green chemistry principles, Friedel-Crafts Reaction, Ferrocene, etc.

Concepts:
Electrophilic Substitution, 'C-C' bond synthesis and green method.

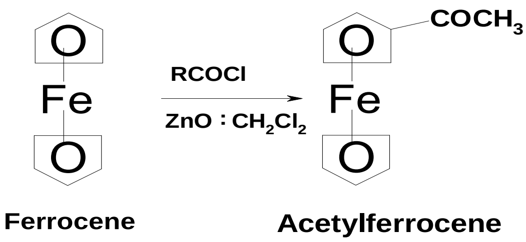
Green Principles:
Less hazardous, Recyclable Catalyst and Energy minimization. Atom economy, etc.

Materials: Ferrocene, acidchloride, Zinc Oxide, Reaction set-up, etc.

Demonstration Experiments:

This experiment focuses on the Friedel-Crafts reaction - a powerful, widely used method of carbon-carbon bond synthesis that proceeds by the mechanism of electrophilic aromatic substitution.

Reaction:



Procedure

In this greener approach[14] ferrocene was acylated with different acid-chlorides over eco-friendly ZnO catalyst at room temperature. The reaction completed in 15 minutes [monitored by TLC] and on normal work up acylferrocene was isolated characterized spectroscopically. The acylation of first ring deactivate the second thus only monoacylated product is obtained. The used ZnO was washed and reused (2-3 times) without loss of efficiency.

Green advantages:
(a) Eco-friendly easily available ZnO as recyclable catalyst.
(b) Room temperature reaction and simple method minimize the energy input.
(c) Small reaction time and less harmful method.

Non-green features
(a) Toxic acid-chlorides (RCOCl) are used as acylating agents.
(b) Chlorinated hydrocarbon, CH_2Cl_2 used as solvent.

The link to this laboratory procedure includes both pre- and post-lab questions.

Post demonstration Work:

Students have been self motivated to overcome the problems of removing non-green features and tried to find more green experiments. Instructor should guide with necessary information. They will also try for other suitable substrates.

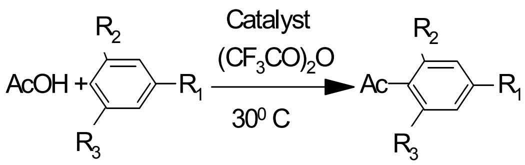
Demo–IV: Solventless Friedel-Crafts Acylation with Carboxylic acids at Room Temperature[14,15]

Objectives: Acylation of aromatics with carboxylic acids as a green alternative acylating agent.
Foundation: Green chemistry principles, Friedel-Crafts Reaction, etc.
Concepts:
Electrophilic Substitution, Catalytic & Recyclable Pathway for C-C bond synthesis.

Green Principles:
Green Reagents, Atom economy and Energy Minimizations, Solvent less reactions, etc.

Materials: $Bi(OTf)_3$ or $Sc(OTf)_3$ with TFAA, Acetic acid, aromatic substrates, Reaction set-up, etc.

Demonstration Experiments:
Reaction



Catalysts: $Bi(OTf)_3$ or $Sc(OTf)_3$ with TFAA ; R_1, R_2, R_3 = H / Me / OMe etc.

Procedure

In this method aromatic ketones are prepared in solventless condition at ambient temperature using recyclable catalysts [metal triflates] with trifluoroaceticanhydride [TFAA]. Both the aromatic and aliphatic carboxylic acids are used as successful green acylating agents. Required amount of catalyst were found 1% mole only. Here recycled catalyst specially, $Bi(OTf)_3$ was found to used without loss of activity[11].

Green advantages
(a) Atom economy of the reaction is higher due to loss of by-product is only water. The water is a small molecule (18) of eco-friendly/ non-polluting nature.
(b) Reaction follows actual catalytic pathways [1% mole] instead of stoichiometric amount in conventional method. Catalysts can be recycled.
(c) Use of green acylating agents [RCOOH] and no solvent make the process green.
(d) Room temperature reaction and simple method minimize the energy requirement.

Post demonstration Work:

Instructor should explain how the green principles are applied to Organic synthesis, specially, towards applications finding more green methods.

Demo–IV: Bromination of trans-stilbene

Objectives: To Test the presence of double bond un-saturation through green methods.

Foundation: Green chemistry principles, conventional tests for un-saturation, etc.

Concepts: Double bond addition and in-situ reagents as green method.

Materials: *trans*-Stilbene - 1.8 g
HBr in water - 5.2 ml
30% Hydrogen peroxide - 7 ml
Ethanol - 10 ml

Demonstration Experiments: **Reaction:**

Stilbene + HBr + $H_2O_2 \longrightarrow$ Ethanol + Dibromostilbene.

Green Procedure**:** *Trans*-stilbene (1.80 g) in ethanol (10 ml) was refluxed. The aqueous solution of HBr (33%) (5.2 ml) and hydrogen peroxide (H_2O_2, 30%) (7 ml) were added from a dropping funnel sequentially to this refluxing solution of stilbene. The colourless solution became deep orange in colour. Within 15 minutes, the orange colour disappeared. This indicates the bromination of stilbene. The solution was allowed to cool down. During this the precipitate due to stilbene dibromide separated out. The precipitate was filtered, recrystallized and dried. Conventional Procedure uses Non-green component of liquid bromine and Chlorinated solvents.

Green context

Corrosive liquid bromine is avoided

Atom efficient method and Water is the only byproduct in this method.

Conclusion

By using demonstrations with proper planning teachers can teach better and inspire the students more effectively.

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eLearning in Era of Communication

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Abstract. We are living in such a phase where we need continuous flow of information in each and every second. Even our today's life processes are running with the introduction of 'e' i.e., 'Electronic'. In the earlier age of civilization, the information was conveyed face to face but with the continuous upgradation of technologies it moved from 'verbal' to 'print' to 'multimedia' to very recently 'electronic technologies'.

Not only in the field of education, business, industry and other sectors, we need continuous information flow in agriculture also. As we know that 65-70% population of our country is dependent on the agriculture as their main source of livelihood, there is a urgent to give latest and continuous information flow on different aspects of agriculture so that the farmers can utilize the information and can compete with the other countries in area of agriculture production, marketing etc. not only this, farmers also want information what is going on all over the world in agriculture area so that they can modify or adopt the new technologies and walk with others. So, it is clear that we have to device such an information technology to benefit the farmers on every aspect on which they want information, and eLearning is the new effort in this direction!

eLearning can benefit every agricultural community around the world, from research scientists in universities or research stations to the poor subsistence farmers of developing countries. It can benefit persons of all ages, all locations, and bridge the gaps created by mountains, deserts, oceans, wars, and political boundaries. eLearning in agriculture can assemble resources and knowledge from distant places that may otherwise be unobtainable. It can connect farmers with far away researchers and experts. It can also dramatically increase the numbers of farmers who can be reached by single training programs. The framers of one country can share the information from the other country on any related aspects.

It can help reach out to the masses. The biggest advantage of eLearning lies in its ability to cover distances. The only requirement is an internet connection which is easily available and at one's own place. eLearning has become a widely accepted method of training and education within schools, colleges and organizations and can be used effectively as mass communication method to reap the gap between the technology generation and adoption.

It seems imperative that eLearning would coexist with other technologies and ways of acquiring knowledge and as soon as low cost PCs would be made available and broadband will penetrate deeper, particularly in rural areas, there are chances that e-learning will strengthen. The government needs to stimulate a learning culture and eLearning must become a policy issue. Also there is need to recognise the eLearning industry as a separate forum

The major hindrance to the acceptance of eLearning can be attributed to the Indian mindset that is more inclined to traditional classroom learning. The programme has to be well designed and publicized well so that it can take off by word of mouth. India is a multilingual country and most of the population knows vernacular language. Hence to make eLearning successful in India the digitized text has to come in these languages also. Rural India can benefit only by establishing eLearning centres with in local languages and the learners would be able to cross cultural boundaries by collaborating with learners from other cultures thereby reducing the gap of digital divide.

Communication of Science and Technology as an Instrument for Social Inclusion

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Abstract. In Brazil, it is a constitutional right that every citizen should have access to knowledge. In this context, it is the mission of the Department of Popularization and Diffusion of Science and Technology to make sure that scientific-technological knowledge is accessible to all. Therefore, the Department promotes and supports events and activities related to science communication and diffusion, in order to reach peoples of all ages, cultural backgrounds, social classes and education. In this context, we pay special attention to The National Week of Science and Technology, an effective tool for science communication and promotion of social inclusion in Brazil.

Keywords: Communication, National Week, Popularization, Science, Social Inclusion

Introduction

Brazil is a large country. Most of the scientific and technological production and dissemination happen in the South and Southeast regions, where the most prominent universities and science centers/museums are located. As a result, only 1% of the population visit a science museum each year. Hence, we face the great challenge of bringing science and technology to isolated regions, where people do not have easy access to such knowledge, and in most cases do not understand the value of science and technology for their lives and for the development of the country. Over the past years there has been an expansion of the actions related to the popularization of science and technology in Brazil, but the structure is still fragile and limited.

In face of this issue, the Department of Popularization and Diffusion of Science and Technology (henceforth “The Department”) of the Secretariat of Science and Technology for Social Inclusion (SECIS), promotes and supports science and technology events and activities, giving priority to the poorest or underprivileged parts of the country, in order to give these vulnerable people an opportunity to learn about science, technology and the scientific development and research in the country. The main purpose is to engage municipalities and local actors so that they will be responsible for designing and implementing activities or events that are most suitable in terms of the local characteristics, such as population (education level, cultural background, etc) and the scientific gaps that exist in their city or region. In supporting local actions, The Department intends to potencialize the learning process and promote social inclusion.

Having this in mind, one of the most important instruments The Department has for science and technology dissemination and popularization throughout the country is the National Week of Science and Technology (henceforth “The Week”). The Week was established in 2004, and its main goal is to mobilize the population, especially children and teenagers, around themes and activities of science and technology, stimulating creativity, scientific thinking and innovation [1].

To implement The Week, each estate has its own local coordination and counts on the active participation of city and estate governments, of education and research institutions and scientific-technological entities.

The paper is structured as follows. In Section 2 we present in more details SECIS and The Department, with their main lines of action. Section 3 introduces the National Week of Science and Technology, its history over the years, its activities, its growth and reach. In Section 4 we describe how communication of science can be used as a tool for social inclusion. Finally, in Section 5 we present our conclusions and future steps.

Actions for Social Inclusion

The promotion of social inclusion has been one of the main lines of action of the Brazilian Government since 2002. When President Lula took over, he committed himself to the improvement of the population’s standard of living, to the creation of new jobs and generation of income, with special focus on the underprivileged.

In this context, the Government created, in 2003, the Secretariat of Science and Technology for Social Inclusion at the Ministry of Science and Technology (MCT). The mission of SECIS is to promote social inclusion through actions that make use of science and technology to improve quality of life, stimulate employment and income generation and lead to the sustainable development of the country.

Regarding the strategic priorities of Science, Technology and Innovation (CT&I) for Social Development, SECIS follows two lines of action:

- Popularization of science, technology and innovation and the improvement of scientific education; and
- Diffusion of technologies for social inclusion and social development.

The Department of Popularization and Diffusion of Science and Technology works under the first line of action above. Its role is to promote and support any activities related to science and technology popularization, such as science fairs and olympiads, science exhibitions, museums, science centers, publications, television and radio programs and films. In order to enable these initiatives, The Department acts together with education and research institutes, scientific entities, governmental organs, newspapers, television and radio stations. The Department also works to strengthen scientific journalism.

Two examples of the events supported by The Department are the Brazilian Fair of Sciences and Engineering (FEBRACE) and The Brazilian Mathematics Olympiad of Public Schools (OBMEP).

FEBRACE is a national fair that stimulates the young scientist. It plays an important social role, encouraging creativity and reflection in students, through the development of projects with a strong scientific basis in the different areas of sciences and engineering [5].

The Brazilian Mathematics Olympiad of Public Schools (OBMEP) is directed to public schools, and has the commitment to show the importance of Math for the future of these youngsters and for the development of the country, besides encouraging young talents and giving opportunities for them to pursue scientific careers [2].

The diffusion of science and technology plays an important role for the development of citizenship, where social inclusion is a natural consequence. Also, it greatly contributes for the consolidation of a strong scientific culture, where science communication is one of the most important factors. In this context, the National Week of Science and Technology is the most successful tool The Department possesses to extend its reach towards all those who are eager for scientific knowledge.

The National Week of Science and Technology

The Week was established in 2004, by means of a presidential decree. It intends to show the importance of science and technology in our lives and for the development of the country, and also offer an opportunity for the Brazilian population to get to know and discuss the results, relevance and impacts of scientific and technological research and applications.

All those who are interested may participate in the activities of The Week. The main actors involved are: universities and research institutions; public and private schools; institutions of technological education, centers and museums of science and technology; scientific and technological entities; research support foundations; environmental parks, conservation units, botanical gardens and zoos; estate and city secretariats of science and technology and education; public and private companies; journals, television channels and radio stations; governmental organs; non-governmental organizations and other entities of the civil society [1].

Among the activities of the Week, there are science tents in public squares; open days in research and education institutions; science fairs; contests, workshops and seminars; scientists going to schools; scientific initiation journeys; scientific excursions; events integrating science, culture and art. In terms of science communication, we can cite the distribution of books and 350,000 copies of the National Week of Science and Technology Journal, the exhibition of films and scientific videos, and the broadcast of science popularization programs on radio and television. Still, 20 DVDs with television programs and scientific diffusion videos from different countries are distributed for public exhibitions in all estates.

Over the years, the Week has seen a substantial growth, both in the number of participating cities and activities developed, as can be seen in Table 1. In 2009, only in Brasília (the capital of Brazil), around 120,000 people visited the stands and exhibitions taking place at the “Tent of Science”, a giant tent erected at the heart of the capital during The Week. The fact that The Week reaches continuously more people, all over the country, clearly shows that it represents a very effective means of communicating science and technology to people of all ages, cultures, social classes and education level, with no distinctions.

Every year The Week has a different theme. On its first edition, in 2004, the theme was “Brazil, Look at the Sky!” and in 2005, “Brazil, Look at the Water!”.

From 2006, the themes were chosen to go hand in hand with an international or national relevant celebration or date. The Week´s third edition worked with “Creativity and Innovation” to celebrate the centenary of 14 Bis’ first flight (the first self-propelled airplane, designed by the Brazilian inventor Santos Dummont). A replica of the plane flew over the Ministry Esplanade in Brasília during The Week. Thousands of educational and diffusion activities paid homage, throughout the year, to the great Brazilian inventor Santos Dummont.

In 2007, the theme “Earth” was chosen to celebrate the International Year of Planet Earth, established by the United Nations (UN). In 2008, The Week was set about “Evolution and Diversity”, because of the 150th anniversary of the Theory of Evolution by Natural Selection, by Charles Darwin.

Finally, in 2009, the theme was “Science in Brazil”, to bring to the general population knowledge about the science and the technology produced in the country. The International Year of Astronomy was also celebrated; thousands of Astronomy activities were promoted during The Week and over the year, reaching around 2,5 million people [1]. Thousands of books, folders and booklets about varied themes (Santos Dummont, Carlos Chagas, Brazilian scientists, Astronomy, experiments, etc) were distributed throughout the country.

Growth of The Week over the years

Year	Cities	Activities
2004	252	1,842
2005	332	6,071
2006	370	8,654
2007	390	9,700
2008	445	10,859
2009	492	24,978

Table 1 – Yearly growth of The Week in the country, in terms of the number of participating cities and activities developed [2].

This year, The Week happened from the 18th – 24th of October, and its theme was “Science for Sustainable Development”. Beyond promoting the most diverse diffusion activities, it stimulated the debate about strategies and ways to use the Brazilian natural resources and its rich biodiversity sustainably, always aiming at an improvement of the socioeconomic conditions of the population. Science for Sustainable Development showed that science and technology are essential factors for the development with social, economic and environmental quality.

On the other hand, the General Assembly of the United Nations declared 2010 as the International Year of Biodiversity. The UN is stimulating all countries to seek a growth in collective awareness regarding the importance of biodiversity, by means of local, regional and international actions. The Week 2010 was designed to go hand in hand with this international effort.

Among the activities signed up for The Week this year, we highlight: science tents in several capitals of the country, like Brasília and Rio de Janeiro; a large popularization event, scientific initiation and science fair at the Federal University of Santa Catarina; the regional representation of The Week at Rio Grande do Norte reached the interior of the state, with the programs Research goes to School and School sees Science; joint actions in the North region, integrating the Brazilian activities with the Colombian National Week of Science and Technology; the first scientific display in Maranhão; the truck of science of the Catholic University of Rio Grande do Sul went to São Paulo.

Preliminary statistics indicate that in Brasília, for example, The Week was quite successful. Most of the attractions were interactive, with displays of live animals to illustrate the biodiversity of the country, hands-on experiences, videos, workshops on the most diverse themes, all related to biodiversity and sustainable development. Data for other estates and cities are still being computed.

The Week as a Tool for Social Inclusion

Brazil is a vast and diverse country, where people from different regions have very different cultural, educational and social backgrounds.

Due to these huge contrasts, it is difficult to reach the whole country in equal measure and a considerable portion of the Brazilian population lacks access to scientific and technological knowledge, museums, science centers, research/educational institutions. This, in turn, contributes to the generation and perpetuation of a society that is illiterate in scientific-technological matters.

Historically, several factors are responsible for this long-standing problem. Usually, the interfaces between science and culture are ignored, as well as ethical questions, which leads to a natural disinterest in science and technology. Also, there is no recognition that scientific production is a process that follows a specific method, involving risks and uncertainties. Science and technology are usually pictured as a black box: something of difficult understanding that is very exclusive, infallible and unquestionable. This picture reinforces the belief that science and technology belong in the universities and research institutes, and cannot be used to generate better life conditions to the poor. Added to the small academic valuation of outreach activities, we have, overall, a very restricted appreciation of the importance that science and technology have for social inclusion.

Moreover, in Brazil there is no tradition in planning public policies for science and technology popularization (even less with focus on social inclusion), which results in a very limited amount of funds destined to support or develop outreach activities.

As a consequence of all these factors, the general perception of science and technology in the country is still very incipient. A survey conducted in 2006 [3] showed that either people do not have the habit of going to museums/science centers or these facilities do not exist where they live. When asked why they are not interested in science and technology, most of the interviewees answered that they do not understand it, therefore, they do not read about science in newspapers or books. Finally, people do not care to discuss science and the latest scientific-technological developments of the country because they think they have nothing to do with it. Paradoxically, most of the interviewees think that science brings more benefits than harm to mankind and agree that funds devoted to the scientific and technological development of the country should be increased. The survey interviewed 2,004 adults, men and women, of different education levels, socioeconomic classes and cultural backgrounds.

We conclude, therefore, that science in Brazil is not properly disseminated. Nonetheless, people are aware that this is an important matter for the development of the country, which means that more actions in science and technology popularization would certainly be welcomed. Note that whatever dissemination movement that existed in the country until now was not directed to poor people, which greatly contributed to their situation of severe social exclusion.

In this context, social inclusion can be reached in three ways: (i) by giving people access to knowledge so that they can understand what is around them and have autonomy to demand solutions for their problems; (ii) by giving people access to knowledge so that they do not feel less important or forgotten by those who had more opportunities in life; (iii) by showing people, particularly children and teenagers, that they can succeed in life and contribute to the development of the country, by following a scientific career, since science is not a black box – it can be understandable by all.

Regarding (i). It is important to start from the principle that the general knowledge of science and technology is part of our society and is the tool to promote the development of the country. Hence, it is essential that this knowledge is available to all, so that people can pose questions, make suggestions and follow the government´s actions and public policies related to science and technology.

The strategic priorities and investments made in science and technology by the government may be determinant for a solid improvement – or not – in the lives of the population. However, the population ignores these facts and feels powerless and disconnected when it comes to making decisions about what science and technology can do for them.

In May 2010, the Brazilian MCT, among others, promoted the fourth edition of the National Science, Technology and Innovation Conference, which analyzed the current situation of the Brazilian Science and Technology System, presented and discussed new proposals to subsidize the creation of a public policy specific for Science, Technology and Innovation in Brazil. This year, among its activities, the Week published and opened for discussion the results of the Conference, giving the population an opportunity to participate in the decision-making process regarding the future of science and technology in the country.

A short version of the “Blue Book”, the final document containing all the resolutions and proposals that arised during the 4th Conference, was distributed as a supplement to The Week´s Journal. This document is now available for public consultation, so that everyone can give their opinions and suggestions about the plans that will guide the Science and Technology Policies for the next years.

Besides being an instrument for science popularization, The Week plays an important socio-political role in calling people to provide some feedback to the government as to what their most pressing needs are and what they expect for the future. The more people understand and participate, the more socially included they feel. And the more benefits they obtain from the developments of science and technology.

Regarding (ii). Since it is difficult to build and maintain museums/science centers everywhere in the country, people must have access to alternative science and technology events/activities. This is one of the main missions of The Week: to reach people who would not have access to scientific-technological knowledge otherwise.

It has been shown that informal events for science learning can stimulate science interest, build learner´s scientific knowledge and skill and help people learn to be more comfortable and confident in their relationship with science [4].

This argument can be verified by confirming that the public response to The Week has been very positive over the years. Its growth, in terms of the number of municipalities involved and activities developed, has been very noticeable, as mentioned in Section 3 and seen Table 1. This means that every year The Week touches more people and extends its reach further into the country. Especially in the North region of Brazil, where access to most of the population is complicated due to the extension of the Amazon Forest, and in the interior of the Northeast region where the poorest people of the country live, The Week brings a new horizon.

These regions are disconnected from the rest of the country and the local populations live in conditions of isolation. It is, therefore, very important to bring science to them, because they have the right to it, and because these actions offer them an opportunity to see their lives through a different point of view – they realize that they can have a better future with science and technology.

As an example, the National Institute of Amazon Research (INPA) promotes events and activities in communities all over the Amazon estate, by means of e.g. online lectures or itinerant exhibitions and displays. It is noticeable that the feeling of self-confidence and social inclusion of these communities are greatly enhanced when they realize that they are part of our society and have the same rights as everybody else (Carlos Bueno, private communication).

Regarding (iii). Science communication is a very important tool to interest people in science, encouraging them to follow scientific careers, therefore building up the human resources needed for the development of the country.

This is a challenge in Brazil, especially because children and teenagers are usually not fond of hard sciences, such as Math and Physics, which originates a serious lack of human resources in these areas, hindering the governmental efforts to promote the scientific and technological development of the country.

Therefore, it is crucial that science is brought to people in an exciting manner. The most effective way to achieve this goal is to create a connection between the science they see during The Week and their everyday lives. Once this connection happens, these people develop positive science-related attitudes, emotions and identities [4], feeling stimulated to pursue more, thus strengthening the scientific-technological culture in the country.

When local actors promote and develop scientific-technological events and activities, it is easier to create a bond with the local population. Direc access to phenomena of the natural physical world is fundamental in this context, where basic aspects of daily life are framed in light of associated scientific ideas [4].

We conclude this Section by reinforncing the many aspects of The Week. It can be used as a tool to reach isolated people and help them develop a connection with scientific-technological knowledge; as a tool to demistify science to people of all backgrounds; as a tool to interest people in science and encourage them to follow scientific careers; and as a tool to disseminate opportunities through which people can express their problems and what they expect from the government and their policies.

All these aspects are complementary and, together, they bring lasting social inclusion. When the population sees science and technology as an asset and not as liability, they can demand the use of the available knowledge to improve their lives. The cycle is closed when people have the chance to be heard, when they can use the knowledge they acquired to bring pressing issues to focus and demand immediate solutions.

Concluding Remarks

Since its first edition in 2004, The Week has been very successful, counting on a growing participation of the general public, institutions and municipalities. This shows that we are moving in the right direction; promoting local scientific events increases interest, proving that science is more accessible to learners when it is portrayed in contexts that are relevant to them, as indicated in [4]. It is worth mentioning that the success of this initiative stimulated other countries (Colombia, Uruguay, Bolivia) to create their own Science Weeks. However, there is still a lot to be done.

Among the main challenges are a greater involvement of the community and research institutions, a more effective integration with the educational system and the widening of the activities at the popular sector levels. Besides, the quality of the public communication that happens during The Week has to be continuously improved, providing more interactivity, stimulating the exchange of cultures, and shortening the relationship between science and technology and the reality of the population, always bringing to focus discussions and debates about the relevance and the ways of science and technology in local, regional and national scales.

Statistics show that The Week reaches around 5% of the Brazilian population. Since the results for 2010 are still being computed, it is possible that this number is higher today. In any case, the goal for 2022, the year of the bicentenary of the Brazilian independence, is to reach 100% of the municipalities in the country, a total of 5,500.

Even though the reach of The Week is still far from ideal, a new public opinion survey conducted in 2010 indicates that the scientific perception is increasing in Brazil. From 2006-2010, although still small, the number of people frequenting museums and science centers nearly doubled. The population, in general, is more interested and participative.

Thanks to the innovative efforts of The Department and the Secretariat to support local activities throughout the country, people in underprivileged regions of Brazil have access to knowledge that, until now, had been neglected to them. Hence, The Week is a very effective and democratic tool to bring science and technology to all Brazilian citizens, contributing to lessen the social exclusion problems we face and to minimize the gaps left by the still small number of outreach activities and events carried out in the country.

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Development of an Educational Program Framework for Science Museum to Foster Public Science Literacy

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Abstract. This granted research focuses on fostering science literacy for all generations. Since science literacy is a comprehensive ability of various elements and requires a long period of time for each person to acquire, science museums need to encourage people to keep learning science even beyond school age.

In the last conference of PCST in 2008, we presented an interim report of our research on developing a framework of educational programs to foster science literacy. Progress afterwards is going to be reported here and the idea on how to proceed for the future will be discussed.

Keywords: Generation, Program framework, Science literacy, Science museum, Society

Introduction

In Japan, research on science literacy has started since 1970's, with the main focus on introducing the research trend in the foreign countries such as the United States and the United Kingdom and discussing the features driven by a different culture. Many domestic researches focus on science literacy for school ages and little is discussed it for the general public.[1] In the advanced countries of science literacy research including the United States, the United Kingdom, Canada, Australia, science literacy is placed as one of the goals of science education. Full Options Science System (FOSS) and Great Exploration in Math and Science (GEMS) are provided as a program system that aims to foster science literacy[2]. However, these attempts also target at formal education.

Science literacy is rephrased as comprehensive abilities and skills of science and it needs to be fostered throughout a lifetime. Thus, all educational institutions need to partner with each other and be responsible for providing opportunities to foster science literacy for the general public. Especially, science museums can be one of best places to create a continuous learning environment that maintains people's curiosity, interest, and positive attitude toward science - not only school students but also the general public at all ages.

This research integrates findings from the previous researches about science literacy within and outside of Japan in order to develop an effective system of continuous educational programs to foster science literacy for the general public.

Overview of the Research

To achieve this objective, we have started the research since 2007 based on two main activities; developing educational programs to foster science literacy and building a framework to organize them. Eight science museums from four areas in Japan have been involved in this research and contributed to practical activities including program design making a good use of particular learning resources of the museums. Twenty-four programs in total are conducted in the cooperating museums in Japan and evaluated to see whether the educational goals are achieved.

(a) Building a framework of continuous educational programs

National Museum of Nature and Science, Tokyo (NMNS) has been discussed what science literacy is for the general public and what is needed to incorporate the concepts of science literacy into educational operations in science museums[3]. NMNS exclaims that science museums need to foster people's science literacy based on the social needs. At the same time, they say that it is needed to develop and provide a system of programs that encourages learners to think the relationships between science and society as a venue to generalize what they have learned. In order for science museums to correspond to the diverse needs of people and solve problems that stem from people's life and social and economic activities, they need to broadly take in account of the relationships of diverse science disciplines with the other disciplines and with the daily life. The social sectors should partner each other in order to deal with various aspects of people's life and provide diverse learning opportunities that would fit various aspects in people's life- not only in schools but also throughout all generations.

Table 1 shows the four goals of fostering science literacy presented in the report of NMNS ; awe and appreciation, knowledge and understanding, attitude and communication. Each category has a detailed goal according to the five divided generations; preschoolers~ elementary school children, junior high~ high school students, university students, adults and families, and middle~ seniors. It considers visions of science literacy that are appropriate for each generation.

On the basis of the framework proposed by NMNS which focuses on 'generation' and 'goals of fostering science literacy', we further examined other aspects of the framework and core ideas are added, 'academic discipline' and 'link with society' as the results of the considerations. Appendix 1 shows the modified framework used in this research.

Table1. Four goals of fostering science literacy (National Museum of Nature and Science, Tokyo, 2010)

Awe and appreciation Become able to deal with science and natural phenomena with curiosity and interest through hands-on activities.
Knowledge and Understanding Become able to understand the characteristics of science and technology in order to make sense of familiar natural phenomena and the functions of technology.
Attitude Become able to identify and analyze questions in phenomena and investigate the solution by applying diverse knowledge and ideas by self.
Communication Become able to express appropriately what has been learned to the other people, and make decisions applying scientific knowledge and attitude in the social context and considering benefits and risks. Become able to participate in developing a sustainable society by returning the wisdom to society conveying own knowledge and skills to the next generation.

(b) Developing educational programs

In developing the programs, the four academic disciplines were set as follows; life, human and the society, space, earth, environment and the society, and materials and the society, and technology and the society. It was determined by reference to the research conducted by Kitahara proposing the visions of science and technology literacy based on seven different disciplines[4]. The programs have been developed based on the target generation of the year since 2007 and a theme of programs was also determined for each discipline throughout the four years. The sixteen categories in the framework divided by the academic discipline and generation are to be fully filled with the programs by the end of this year (See Apendix1). Twenty-four programs in total are conducted in the cooperating museums in Japan and evaluated to see whether the educational goals are achieved.

All programs contain hands-on activities including observation, sketching, coloring, crafting and experimenting. As a link with society has been carefully considered in designing the programs, participants' interest and free-choice learning are assured. Following is a brief overview of major program implementation:

Life, human and the society:

'Food and health' is the theme of this discipline, aiming to understand natural life and interaction between human and nature with a familiar view point seeing natural life as a food. "Coloring in Pictures at Science Museum' encourages children to understand the features/appearance of the animal better by closely observing the specimen of animals that people eat in the daily life and coloring it on a sheet of paper. This program was implemented in a "first-come, first-served" basis and aimed at facilitating children's sensitivity toward science in a creative way[5].

Space, earth, environment and the society

The programs of this discipline have been developed with the theme 'Gift from the earth'. It aimed to seek answers to a question asking 'where were we born? , where are we now? , and where are we going to go?' by finding social issues from a scientific viewpoint and making decision with knowledge. In 'Let's play with pebbles of rivers', children became able to notice that each pebbles on the shores of a river had different features- touch, color, smell, shape and so on, and through crafting the pebble that they chose, they tried to grow their creativity and the ability to tell others what they made. As the further learning, the program aimed to let the children know that there was the relationship between pebbles on the shores and rocks on the upper stream of a river.

Materials and the society

'Materials supporting our life' was set as a theme of this discipline, aiming to increase opportunities of the effective use of materials in our daily life. The programs help participants to gain a concept and a viewpoint at the micro level to understand materials and various chemical changes. 'Investigate the micro world' encouraged children to understand the shape of a material through observation of magnified pictures of the material. The children could see that a material looked different when magnifying through interaction with their family and museum staff.

Technology and the society

The programs of this discipline focus on a theme, ‘Technology supporting our life’, encouraging participants to choose the direction of technology supporting the modern society from the comprehensive standpoint in their life. ‘Investigate electric energy through a pinwheel’ starting from understanding of the electricity bill, children learned the basic mechanism of electricity, the role of electricity in the daily life. It led to the discussion on how valuable electric energy is, and why we should care about energy conservation.

(c) Evaluating the educational programs

In a process of evaluation, the framework of science literacy proposed by NMNS which shows the visions when fostering science literacy in science museums was reexamined and revised based on the literature that shows the basic concepts and examples of science literacy. This enabled us to evaluate programs with clear and measurable viewpoints resulting in a more practical and feasible evaluation[6]. Literature referred includes PISA 2006[7], Pan Canadian Protocol[8], Generic Learning Outcomes[9], Twenty-First Century Science[10], and Iowa Assessment Handbook[11] .

The viewpoint of the evaluation in this research is to measure the extent how the program contributed to fostering science literacy. However, science literacy should be fostered with taking enough time as mentioned earlier and it is quite challenging to measure it only within what they experienced during the program. Thus evaluation in this research included how their further interest and positive attitude toward science learning was stimulated by the program as well as the achievement of the goals in the program and the awareness of science for the participants.

The actual procedure of the evaluation is divided into the following three processes.

(a) A framework of evaluation was developed based on the framework of fostering science literacy proposed by NMNS with referring literature on science literacy. The evaluation framework can be incorporated practically into program development and be feasible in evaluating programs

(b) Viewpoints of evaluation are chosen from the evaluation framework based on the goals, contents, and targets of the program. These viewpoints are not limited to the ones.

(c) Evaluation methods and tools are determined based on the items chosen to evaluate the program, which include questionnaire to the participants, observation of participant’s behavior, and analysis of the worksheet completed by the participants and so on.

Research outcomes and future prospects

In this research, we developed, implemented and evaluated programs for all generations. Each program featured aspects of facilitating sensitivity, deepening understanding of scientific knowledge and concepts, facilitating scientific thinking and making right decisions in the social context, and enhancing the ability to communicate and apply scientific findings.

Although a number of programs are conducted in museums, no study has been found that reported a program system based on diverse generations including adults. This research has attempted to develop such a program system throughout the generation, which is quite original.

There are overall outcomes from the research as below;

(a) A focus on science literacy in developing programs showed validity of the program and correlation with science literacy. The approaches of the programs considering unique factors such as generation and a link with the society clarified special features of museum education.

(b) A variety of evaluation practices provided other museums suitable methods and tools to measure educational impact on visitors in informal learning settings.

(c) The framework of educational programs to foster science literacy;

- gave a new perspective on how people engage in science throughout lifetime.
- provided a common scheme responding to the situation of science museums across the country to organize its educational activities and draw a comprehensive educational strategy.

The programs need further improvement by implementing in various forms of learning settings, which would lead to expansion of the versatility and dissemination of the programs. Establishing the educational program database based on the framework of the research can also be effective in order to widely share the idea of fostering science literacy. 'Intergenerational learning' would be the next keyword of the research to enhance a diverse type of science communication and developing programs that connect between different generations needs to be considered. Although the aim of the research is to foster science literacy of individuals, it is assumed that communication between individuals would enhance science literacy of the society as a whole.

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Year	2007	2008	2009	2010
Generation / Discipline	Preschoolers～ Elementary School Children	Junior High～ High School Students	University Students, Adults and Families	Middle～Seniors
Life, Human and the Society	●Coloring in pictures (2 versions)	●Let's make a dino-digging cake ●Sweet relationship between volcanoes and our life	●We are beach explores – Let's know everything about our local marine environment!	●Gift from Japanese Climate –Sweet potatoes; then and now
Space, Earth, Environment and the Society	●Let's play with pebbles of rivers (2 versions)	●Let's become a gold hunter ●Fossils give the past environment	●The tour of the earth –present, past, future –	●Our life and the earth - making geo-guidebook program for adults -
Materials and the Society	●Investigate the micro world	●Let's make brilliant metal from rust or mineral ores ●Electrons play the leading parts in chemical reactions	●Chemical change is just about everywhere – connecting to dailylife with chemistry -	●Making the museum worksheets for children
Technology and the Society	●Investigate electric energy through a pinwheel (2 versions)	●Time trial using MINDSTORM NXT® ●A story of water	●Designing a model robot for daily life	● Home electrical appliance workshop: looking at past and future of technology

Appendix1. Program plan

Communication of Literature in Chemical Sciences to Researchers From Research Centers Situated in and Around Pune City (A representative model for communication of science to researchers)

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Abstract. Chemical sciences include a variety of branches related to most of the fundamental and applied sciences. Large numbers of research programs are engaged in association with chemical sciences at different levels. Awareness and ready availability of up-to-date reference literature is a basic for a quality-based and standardized research work. Considering the huge number of research centers and innumerable researchers, establishment of appropriate means for the communication of relevant scientific literature amongst these researchers will be a novel concept of current interest.

In India, there are numerous educational institutes, research centers, senior colleges and university departments where research is carried out in different fields. Large number of students, teachers and research fellows are engaged in advance research. However, the situation in most of the colleges and newly established universities is not ideal in connection of appropriate facilities for reference work. Many researchers and teachers are unaware about the necessity and importance of up-to-date scientific knowledge for research purpose. This problem has risen from communication gap between experienced and budding scientists. Therefore, a five component working model designed for the purpose of communication of science to these researchers will be highly appreciable in educational and research field.

Chemistry being the most fundamental science was selected as a representative example. With this background, the main object of this project was to undertake a detailed and systematic study of the current status of the use of literature in chemical sciences by researchers from selected research centers in and around Pune city. In this, the main task was to realize the present situation regarding the awareness towards the importance and necessity of reference work. This helped in creation of an appropriate foundation for planning and carrying out the research work in proper direction. For practical convenience, the researchers were classified into different categories like students, teachers, research fellows, research supervisors and other faculty members. Specific requirements of each category were considered. A survey of the type and nature of reference literature to be referred by research workers belonging to different categories was undertaken. From this survey, attempts were made to establish appropriate recommendations and communicate the same to researchers. This model was found to be useful to most of the researchers which resulted into a fruitful research work.

The five component model designed for actual working purpose included (a) personal interviews with researchers (b) communication through correspondence, questioner and e-mails (c) survey of departmental libraries (d) citation analysis of the dissertations (e) data of research publications in national and international journals and their assessment in the light of impact factors and citation index.

Keywords: Reference literature, Five Component Model

Postal Stamps: A Novel Approach for Public Communication of Science and Technology

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Abstract. Utilization of postal stamps for public communication of science with special reference to awareness of scientific progress and ideas is a novel concept. It can be effectively applied as a convenient tool for popularization of science.

The most easiest and economic means of communication and correspondence is provided through Department of Post and Telegraph of the respective nations. Postal stamps are the significant articles, handled routinely. Due to attractive and intellectual designs, these postal stamps are the subject of special interest and hobby for everyone, right from children to senior citizens. Accordingly, department of posts is skillfully employing these means of popularization and publicity for cultivation and nurturing science and technology within our society. Philately is a global organization of philatelists, established by the department of posts from most of the advanced countries, which is working at national as well as global levels. Publication and distribution of new stamps to philatelists is an efficient and regular job of philately. From the huge number of stamps published by philately, specific postal stamps can be selected.

Collection, classification and projection of postal stamps related to a specific area of interest, at appropriate educational and public places will be an attractive promotional activity. Actually, such exhibitions are organized by philatelists and concerned agencies in all important cities of world, including India. In such exhibitions, there is exchange of stamps amongst the interested philatelists. Along with the publication of new stamps, relevant literature related to these stamps is also published periodically by the department of posts and other concerned agencies.

As a part of our contribution in communication and popularization of science and technology through this novel approach, this project has been initiated. This includes collection, classification and preservation of postal stamps related to science and technology along with their projection and exhibition for education and research purpose. An attempt is been made to develop innovative means for communication of science to society by undertaking such activities.

Our project was concerned with the use of postal stamps for the communication of science to society. Stamps related to various aspects of science are divided into three groups as:

1. Stamps in honor of commemoration of reputed scientists
2. Stamps related to medicinal plants with importance in human health
3. Stamps devoted to significant inventions in the field of science and technology

Collection and presentation of these stamps will reveal the relevant details along with significant events to underline their use.

Keywords: Department of Post and Telegraph, Philately

Effects of Newspapers in Education (NIE) Intervention with News Reports about Global Warming: A Cognitive Learning Perspective

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Abstract. The purpose of this study was to exam the effectiveness of an intervention of Newspapers in Education (NIE) which focusing on global warming. A nonequivalent experimental control group design was used. The participants were 209 students in the continuing education division of a technology college in Taiwan. There were 106 students in experimental group, and 103 students in control group. The intervention materials were 150 newspaper reports about global warming selected from Taiwanese newspapers published in 2009. Students in experimental group read five reports each day for one month, while no any intervention was made in control group. The results showed that when media usage behavior and issue involvement in global warming were controlled, the intervention of NIE had significant effectiveness on the concept connections between related concepts (including global warming, climate change, green industry, green consumption, and environment policy). Attitudes toward green consumption and green consumption behavior also increased significantly in experimental group. This study suggests that news media is an effective tool for dissemination of science information. Science news reports selected appropriately could be used as educational materials for science education.

Keywords: global warming, Newspapers in Education (NIE), news, science education, science communication

Introduction

Since the industrial revolution, people have been extensively using fossil fuels such as coal and oil in pursuit of economic growth, resulting in a significant increase of greenhouse gases in the atmosphere (Huang, 2007). In consequence greenhouse effects have caused an increase in the average global surface temperature, and have had a serious impact on the global climate. In addition to the international community's commitment to the reduction of greenhouse gas emissions, people have to seriously consider the post-global warming state of the environment and adjust existing life styles, to face the seemingly irreversible global warming and climate change phenomena (Ku, 2008).

People have more and more diverse channels of knowledge acquisition. In everyday life, knowledge learning through informal channels, such as travel, visits, mass media, newspapers, magazines, the Internet, and multimedia, have been gradually increasing. Millar (1997) pointed out that science or technology impacts can be directly perceived by the general public mostly through news reports on social or scientific issues. Cultivation theory pointed out that the long-term influence of media will affect people's perceptions, attitudes, and behaviors (Morgan & Signorielli, 1990). Among the different types of mass media, newspapers are an important source of information.

In the consumer-oriented era, the collective environmental awareness of consumers has a dominating influence on the market toward green production. Promoting the cognitive between the environment and consumption behavior through public education is a key to the promotion of green consumption. Studies on Newspapers in Education (NIE) of global warming-related issues are scarce. This study can help us to understand the effectiveness of NIE about global warming.

Economic growth

Over the past few decades, unprecedented economic expansion has made the global economy a trend. The focus of international development in the past 20 years has been to accelerate the integration of developing nations into the global economy through the structural adjustment plans and policy mechanisms of the International Monetary Fund and the World Bank (Roseland & Soots, 2007). The industrial economy has changed tremendously. Cities dominated by industry for a long time are now ready to grab the next wave of global economic opportunity, which is linked to green and clean development (Sawin & Hughes, 2007).

Global warming

In recent decades, due to the rapid increase in population and fast industrial development, carbon dioxide generated from the heavy use of fossil fuels, such as coal, oil, and natural gas, has been far greater than the level of carbon dioxide formed naturally. Coupled with mankind's deforestation and vegetation destruction, as well as the reduction of tropical rainforests, chances to convert carbon dioxide to organic compounds through plants have been declining. Large quantities of greenhouse gases are being discharged, resulting in a rapid increase of the carbon dioxide concentration in the atmosphere and strong greenhouse effects (Liu, 2007).

Climate change

The rapid development of the global economy has resulted in a significant increase in energy use and a sharp rise in the consumption of fossil fuels. Coupled with the large-scale deforestation of land resource development, the global carbon cycle has been damaged, causing the recent warming trend and creating a significant impact on the climate (Ku, 2008). The rising average global surface temperature will have an impact to a certain degree on the weather systems in every region. More and more evidence suggest that global warming has started to cause chaos in the climate systems of many parts of the world, affecting ecosystems and endangering the stability of the human environment (Su, Lin, & Chen, 2008).

Environment policy

In December 1997, on the third conference of contracting members of the United Nations Framework Convention on Climate Change held in Tokyo, Japan, member nations adopted the legally binding Kyoto Protocol. The Kyoto Protocol came into force on February 16, 2005, requiring developed nations to reduce the emissions of six greenhouse gases between 2008 and 2012 (Chan & Hung, 2007; Huang, 2007).

Green industry

In recent years, the EU has released a number of EU environmental directives or regulations, such as RoHS, WEEE, and EuP, directly forcing manufacturers of products entering the EU market to comply with specific environmental requirements. The EuP directive stresses that manufacturers using energy products should assess the environmental impact of their products at various stages, including raw materials, manufacturing and assembly, transportation and distribution, usage and maintenance, and discharge and recycling, and propose concrete measures to improve their environmental impact. Wang, Kuo, & Tang (2007) pointed out that industries and supply chain systems should respond in real time and actively integrate the considerations in the environmental perspective in order to incorporate the ecodesign or design for environment concepts and technology during the product design stage.

Green consumption

Peattie (1992) believed that green consumption means that consumers are aware of environmental degradation and try to buy goods that minimize their impact on the environment, thus achieving their consumption purpose while reducing damage on the environment. Green consumption is the pursuit of sustainable and socially responsible consumption. The behavior criteria for consumers buying green products include reduce, reuse, recycle, regenerate, repair, refuse, and recover.

The global warming related issues summarized in this study included global warming, climate change, environment policy, green industry, green consumption and economic growth.

Methodology

The cognitive association graph of the global warming-related issues proposed in this study is shown in Figure 1, and was the framework of this study with a total of 30 paths of influence.

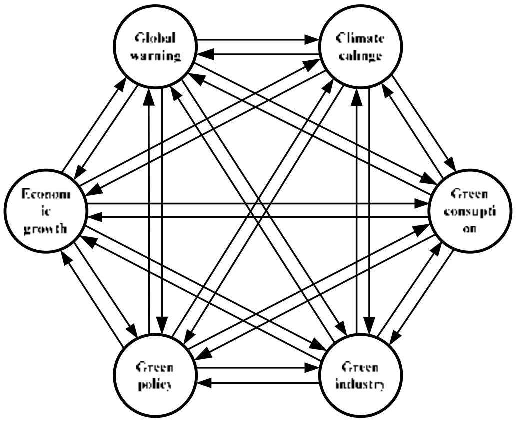

Figure 1. Conceptual model

Study design

This study used the nonequivalent control group design shown in Table 1. The pre-experiment and post-experiment tests used the same measurement tools. In this study, five variables were used as covariates, including number of hours per week spent reading newspapers, number of hours per week spent watching TV, number of hours per week spent listening to the radio, number of hours per week spent online, and degree of global warming-related issue intervention.

Table 1. Experiment design

Group	Pre-test	Intervention	Post-test
Experimental group	Y1	X	Y3
Control group	Y2		Y4

Subject

The research subjects were 209 students from the continuing education division of a technology college in Taiwan, who were divided into an experimental group with 106 subjects and a control group with 103 subjects.

Intervention

The intervention materials were 150 newspaper reports about global warming selected from Taiwanese newspapers published in 2009. Students in experimental group read five reports each day for one month, while no any intervention was made in control group.

Measurement

This study used self-developed questionnaires as research tools. The variables included connections between global warming related concepts, attitude toward green consumption, green consumption behavior, issue involvement in glogal warming issue, and media usage behavior (Shih Hsin University, 2007).

Results

Regarding connections between global warming related concepts, both the experimental group and the control group believed that there was a positive relationship between global warming, climate change, environment policy, green industry, green consumption and economic growth. To exam the effect of NIE intervention on cognitive, this study employed group as independent variable, post-test of connections between global warming related concepts as independent variables, and with pre-test of connections between global warming related concepts, issue involvement in glogal warming issue, and media usage behavior as covariates for validation. According to ANCOVA analysis results, after intervention, a total of 14 post-test variables of concepts connection have significant differences between experimental and control groups at $p<.05$ significance level (as shown in Figure 2).

To verify the changing effects of intervention on attitudes toward green consumption and green consumption behavior, this study used group as independent variables, post-test of the attitude toward green consumption and green consumption behavior as dependent variables, and with the pre-test of the attitude toward green consumption, green consumption behavior, issue involvement in glogal warming issue, and media usage behavior as covariates. The ANCOVA analysis results indicate that NIE had a positive impact on attitudes toward green consumption and green consumption behavior.

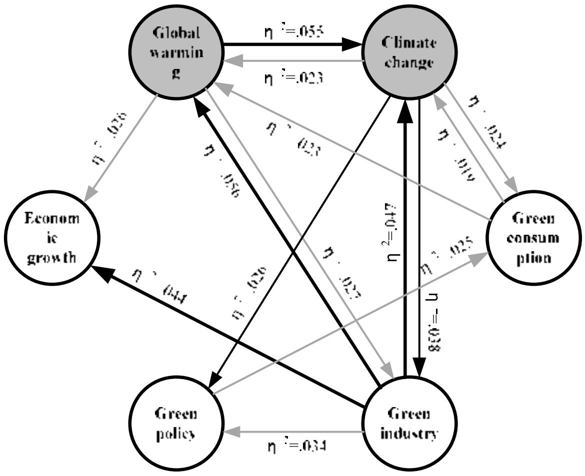

Figure 2. The effect of NIE on concept connections regarding global warming

Conclusion

The NIE intervention enhance concept connections regarding global warming

The NIE of global warming related issues has an enhancing impact on the concept connections of adult students. Such impacts can be found in issues such as the global warming, climate change, green industry, and other topics.

The effect of NIE intervention on green consumption was indirect

After intervention the cognitive enhancement effect of global warming affecting green consumption was mainly achieved through paths as "global warming → climate change → green consumption", "global warming→climate change →environment policy", and "global warming→ climate change → green industry → environment policy→green consumption" .

The NIE had a positive impact on attitudes toward green consumption

For global warming-related issues, NIE can positively improve the attitude toward green consumption of adult students. The students believed that they should improve their consumption behavior, persuade others to participate in green consumption, affect enterprises to invest in green industries, support the green polices of the government, and should take on environmental protection responsibilities.

The NIE had a positive impact on green consumption behavior

NIE for global warming-related issues can help improve the green consumption behavior of adult students. They believed they would follow the green consumption behavior criteria, including reducing usage, the reduction of unnecessary waste, recycling, regeneration, repairing, the rejection of ecologically harmful products, and ecological restoration.

Suggestion

NIE can be an usful method for environment education about global warming

The results suggested that NIE can be used to environment education. Goverment and school can use NIE to the promot energy savings and carbon reduction. News stories can be edited for teaching materials according to learning theories and teaching material compiling principles.

Increasing causal links of global warming related concepts in news reports

As the experimental results suggest, the concept connections between global warming affecting green consumption was not yet significant. It was recommended to increas the causal links of global warming related issues to help readers in their cognitive construction.

Analyze the content of news reports regarding global warming issues

This study did not analyze the content and fram of news reports regarding global warming. In the future, it was recommended to further analyze the content to understand what are the newspaper cover news reportes about global warming.

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The Content and Frame of News Coverage about Global Warming in Taiwan

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Abstract. The news media is a major source of science information for the general public. The purpose of this study was to understand what are and how the newspapers in Taiwan cover news reports related global warming. Keywords searching and systematic sampling was used to select 548 newspaper reports on global warming from the three most widely read newspapers in Taiwan published from 2005 through 2009. A content analysis was conducted to analyze the content and frame of news coverage. The results showed that the main issues of news reports related to global warming were environment policy, green industry, climate change, green consumption, and global warming. The environment policy, green consumption, and green industry issues often appeared in conjunction with each other, and global warming and climate change often appeared in conjunction together as well. Reports on global warming were usually presented as a rational appeal style; as reports on climate change were often contained fear appeal messages, whereas, reports on environment policy, green industry, and green consumption usually contained information of reward appeal. This study suggests that for improving audience's knowledge about complex environment issues and problems, news reports on global warming should provide more links between related concepts. The practical implications of these findings and directions for future research are addressed.

Keywords: Global warming, News, Science communication, Content analysis

Introduction

The media is a public instrument of society, and one of its functions is education. According to the cultivation theory, long-term influence of the media would deeply affect the perception, attitudes, and behaviors of the public (Morgan & Signorielli, 1990). Mass media is an important source of environmental knowledge for the public, and is an important channel for the government and its people to engage in communications regarding environment policy (Wakefield & Elliott, 2003). For the perspective of science communication, what are and how the newspapers cover news reports related environment problem is an important issue.

Through analysis the new reports regarding global warming, the study was aimed to understand the contents, news sources, and reporting frames of news reports regarding global warming on domestic newspapers in Taiwan. Get an insight of the contents and frames of news coverage regarding global warming can help us understand the information received by the public through the news. In turn, the insight of these news reports can also be used government to carry out communication regarding environment policies, and for journalists to produce news reports regarding environmental science.

Methods

Sample

The three most widely read newspapers in Taiwan were chosen for this study. According to the survey by Nielsen Media Research, the three most widely read newspapers in 2008 were Apple Daily, Liberty Times, and United Daily News. The sampling period was from January 1, 2005 to December 31, 2009.

Based on literature review, 29 terms related global warming were used as search keywords which used "or" as a Boolean operator. The keyword searching was conducted from the electronic databases of the three newspaper companies. If the article lowly correlated with global warming, it was deleted. A total of 3653 articles were retrieved. These articles were sorted by their published date, and systematic sampling was applied to extract 15% as the sample.

Finally, 548 news reports were selected as samples for analysis of this study. Table 1 shows the published newspaper and year of the population and sample news reports. The Chi-square test results show that the amounts of reports from three newspapers are no significant difference between the population and the sample.

Of the total news reports, 57.7% (n=316) were featured in United Daily News; 27.6% (n=151) were in Liberty Times; and 14.8% (n=81) in Apple Daily. There is a significant increase in the amount of reports regarding global warming at 2007.

Table 1. The published newspaper and year of the news reports

	Newspaper						Totals	
	United Daily News		*The Liberty Times*		*Apple Daily*			
Year	N	n	N	n	N	N	N(%)	n(%)
2005	183	28	112	15	75	12	370(10.1)	55(10)
2006	172	30	130	15	95	15	397(10.8)	60(10.9)
2007	556	80	382	58	153	25	1091(29.9)	163(29.7)
2008	504	82	169	21	122	17	795(21.8)	120(21.9)
2009	624	96	287	42	89	12	1000(27.4)	150(27.4)
Totals (%)	2039 (55.8)	316 (57.7)	1080 (29.6)	151 (27.6)	534 (14.6)	81 (14.8)	3653 (100)	548 (100)

N: the number of news reports of the population.
n: the number of news reports of the sample.

Coding scheme

Each news report was coded for 6 variables.

Five issue categories were developed including global warming, climate change, environment policy, green industry, and green consumption. One news story may include one or more issues. The main topic and sub-topic were coded based on their weight in the story.

The source of news was coded. The category items included government or official institutions, academic institutions or experts and scholars, non-government organizations, private corporations, and other media or without sources. Reports that source of news unknown were classified under the fifth category. Location of sources of the news was coded as domestic or foreign.

Report style referred to the style of the report was published on the newspaper. It was divided into five categories including straight news, commentary, special theme report, op-ed, and translation reports.

The attribute of reports can be divided into six categories including composite report, policy story, knowledge story, research story, consumption story, and economic story.

When the report contained anti-warming information and was in an attempt to convince the audience, it can be analyzed for the appeal strategy. Category items included fear appeal, reward appeal, emotional appeal, rational appeal, authority appeal, and no appeal. One story may contained one or more appeal strategies. Only the main was coded.

Data analysis

Three coders were trained before analysis. The training involved 30 articles not used in the sample. The training articles were coded and discussed by all three coders until they felt comfortable with the coding scheme. Among all categories, the intercoder agreement ranged between 0.677 and 0.982. The whole intercoder agreement among three coders ranged between 0.847 and 0.868. The average intercoder agreement was 0.835, and the reliability was 0.938.

Results

Issues of news reporting

Of the total 548 news reports regarding global warming, 51.1% (n=280) concerned environment policy issue, 20.1% (n=110) concerned green industry issue mainly (Table 2).

With respect to sub-topic, green consumption (34.1%) and global warming (33.8%) comprised the majority. It is worth noting that 10.2% of the stories only concerned an issue but did not implicate another related issue as sub-topic.

In one news story, the issues of main topic and sub-topic are presented on table 3. Environment policy most often appeared with green consumption (29.7%), followed by global warming with climate change (16.3%), then environment policy with green industry (13.2%), green industry with green consumption (13.0%), and followed, global warming with environment policy (12.0%). It is notable that climate change only appears often with global warming, but rarely with other issues.

Table 2. Main topic and sub-topic of the news reports

Issues	Main topic n (%)	Sub-topic n (%)
Environment policy	280 (51.1)	17 (3.1)
Green industry	110 (20.1)	74 (13.5)
Climate change	92 (16.8)	29 (5.3)
Green consumption	52 (9.7)	187 (34.1)
Global warming	13 (2.4)	185 (33.8)
No sub-topic	0(0)	56 (10.2)
Totals	548 (100)	548 (100)

Table 3. The cross tab of multi-issues within one reports

Issues n(%)	Climate change	Environmental policy	Green industry	Green consumption
Global warming	80(16.3)	59(12.0)	30(6.1)	23(4.7)
Climate change		18(3.7)	4(.8)	3(.6)
Environmental policy			65(13.2)	146(29.7)
Green industry				64(13.0)

Sources of news

Table 4 presents the details of the news coverage. Of the total, the largest percentage for source of news is government institution (32.3%), and the second is academic institution (23.7%), the sum of both comprise over half of the total. Global warming and climate change reports mostly came from academic institution (53.8%, 44.6%), environment policy reports mostly came from government institution (50.0%), while green industry news mostly came from private corporation (40.0%). There are 71.5% reports came from domestic sources totally. But climate change reports mostly came from foreign sources (58.7%).

Attribute of reports

Of the total, the majority of the attribute of reports is straight news (53.5%), follows by translation reports (25.7%). The percentages of op-ed (6.9%) and commentary (1.6%) are the lowest. Separate by issues, translation reports account for over half of the reports for global warming (61.5%) and climate change (51.1%). Reports on environment policy (61.4%), green industry (49.1%), and green consumption (64.2%) tend to be presented as straight news mostly.

Style of reports

Of the total, the majority of the styles of reports are composite report (29.0%) and policy story (29.0%). Reports on global warming and climate change are generally in research story (53.8%, 73.9%). Environment policy reports are primarily in policy story (50.0%) and composite reports (40.0%). Green industry reports generally appear in economic story (36.4%), and composite reports (20.0%), while green consumption reports generally appear in consumption story (35.8%) and composite reports (34.0%).

Table 4. Coverage of global warming relevant issues in newspapers

Category	Global warming n(%)	Climate change n(%)	Environment policy n(%)	Green industry n(%)	Green consumption n(%)	Totals n(%)
Source of news						
Government	1(7.7)	16(17.4)	140(50.0)	12(10.9)	8(15.1)	177(32.3)
Academic institution	7(53.8)	41(44.6)	49(17.5)	21(19.1)	12(22.6)	130(23.7)
Media	4(30.8)	21(22.8)	38(13.6)	29(26.4)	14(26.4)	106(19.3)
Private corporation	0(0)	2(2.2)	18(6.4)	44(40.0)	13(24.5)	77(14.1)
Non-government organization	1(7.7)	12(13.0)	35(12.5)	4(3.6)	6(11.3)	58(10.6)
Location of source						
Domestic source	8(61.5)	38(41.3)	219(78.2)	79(71.8)	48(90.6)	392(71.5)
Foreign source	5(38.5)	54(58.7)	61(21.8)	31(28.2)	5(9.4)	156(28.5)
Attribute of report						
Straight news	3(23.1)	30(32.6)	172(61.4)	54(49.1	34(64.2)	293(53.5)
Translation report	8(61.5)	47(51.1)	54(19.3)	27(24.5	5(9.4)	141(25.7)
Special report	1(7.7)	9(9.8)	16(5.7)	28(25.5	13(24.5)	67(12.2)
Op-ed	1(7.7)	5(5.4)	30(10.7)	1(.9)	1(1.9)	38(6.9)
Commentary	0(0)	1(1.1)	8(2.9)	0(0)	0(0)	9(1.6)
Style of report						
Composite report	1(7.7)	6(6.5)	112(40.0)	22(20.0)	18(34.0)	159(29.0)
Policy story	2(15.4)	5(5.4)	140(50.0)	9(8.2)	3(5.7)	159(29.0)
Research story	7(53.8)	68(73.9)	7(2.5)	6(5.5)	2(3.8)	90(16.4)
Consumption story	0(0)	6(6.5)	9(3.2)	18(16.4)	19(35.8)	52(9.5)
Economic story	0(0)	3(3.3)	7(2.5)	40(36.4)	0(0)	50(9.1)
Knowledge story	3(23.1)	4(4.3)	5(1.8)	15(13.6)	11(20.8)	38(6.9)
Appeal strategy						
Reward appeal	0(0)	0(0)	130(46.4)	54(49.1)	38(71.7)	222(40.5)
Rational appeal	7(53.8)	12(13.0)	70(25.0)	46(41.8)	11(20.8)	146(26.6)
Fear appeal	5(38.5)	75(81.5)	17(6.1)	4(3.6)	1(1.9)	102(18.6)
Authority appeal	1(7.7)	0(0)	55(19.6)	2(1.8)	2(3.8)	60(10.9)
Emotional appeal	0(0)	1(1.1)	6(2.1)	1(.9)	1(1.9)	9(1.6)
No appeal	0(0)	4(4.3)	2(.7)	3(2.7)	0(0)	9(1.6)

Appeal strategies

Among the news texts of this study, there are many appeal strategies used to convey the concept of anti-warming. On the whole, reward appeal holds the largest ratio, and emotional appeal is the least utilized. However, different topics utilize different appeal strategies. Global warming topics generally use the rational appeal, followed by fear appeal; climate change news generally uses fear appeal; environmental policy, green industry, and green consumption topics generally use the reward appeal followed by the rational appeal.

Discussion

From the perspective of learning, display the related concepts and their relationships simultaneously can assist in establishing conceptual connections for audiences. News reports concerned environment policy issue often accompanied by green consumption issue. It shows that when news media deal with global warming issue, they tend to convert policy level information into personal level. The distance between policy and audience is long. However, consumption information implicates audience's personal actions. Mentioning environment policy and green consumption in the same news story is beneficial in helping audiences establish connections between policies and themselves. However, while "climate change" only appears often with "global warming" but rarely appears with another issues. Audiences can't establish connection between climate change and other related issues such as environmental policy, green industry, and green consumption through reading the news reports..

In terms of news source, most news stories on global warming and climate change were from academic institutions or experts and scholars, which indicate the cognitive characteristic of such science news. Approximately 30% of the total news and 50% of climate change news came from foreign sources. In addition, global warming and climate change reports are mostly translation reports. It shows that there is greater reliance on foreign media for these two issues. Global warming is an international issue. News from overseas can present the global climate change conditions and the developmental trends in fighting global warming in other nations. It is helpful in establishing an international perspective for this issue. But high frequency uses of translation reports may have a negative effect on the comprehensiveness and depth of domestic science news (Huang & Jian, 2006).

In terms of news attribute, op-ed and commentary account for less than 10%. Environment issues are not merely scientific, but are closely related to social domain. Environment policies especially demand exchanges of opinions from different departments of society in order to gradually form the consensus. News reports regarding global warming rarely appeared in commentary, meaning that the journalists in Taiwan may not engage in discussion such issues. The paucity of op-ed also means that the people participate less in such issues. In addition, it usually does not appear in special reports. Special reports are usually more breadth and depth, and are good to communicate the high density knowledge and complexity of science news. However, the low percentages of these types of news mentioned above should be improved upon in the future.

In order to motivate audience to engage in anti-warming, it may rely on the rise of environment consciousness and emotional love for the planet. However, this study discovers that only 4 news stories assumed an emotional appeal. In the future, the emotional appeal strategy can be used more.

Limitations

The analytical sample in this study was taken from the three most widely read newspapers. However, they do not represent all newspapers published in Taiwan. The samples were obtained through electronic database of newspapers; thus, the content was only textual, and without images and color. Electronic newspapers also have a different layout from paper newspapers. In addition, the characteristics of television, broadcasting, and newspapers are different, thus, the results of this study cannot be generalized to other news media.

Implications

The study findings suggest that when write global warming news reports, more related issues can be put in one story. It would help the audience establish connections between issues through reading. It is suggested that commentary and op-ed could be used more often to strengthen discourse on environment policy, and to achieve the communication with the public.

Future studies can deal with audiences, to explore how the public interprets news reports on environmental issues, and how reading news reports affects the audience's knowledge of, attitude toward, and behavior for anti-warming.

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NETA-Science: scientific knowledge without requiring the correctness --Implication from science boom in Japan

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Abstract. Recently there has been a boom in brain science among the public in Japan. Products promoting concepts such as “train your brain” or “condition your brain to adopt good habits” including books, toys, TV programs, and digital games, are very popular among the Japanese public. Although many Japanese neuroscientists have criticized this “boom”, this trend has not slowed down.

In this presentation, we focus on the term *Nou-Tore* (“Brain Training”), the centerpiece of the boom in neuroscience, and investigate how the mass media treats the information about *Nou-Tore*, which neuroscientists regard as nonscientific. We found that information about *Nou-Tore* in the mass media included the scientific words. However, these scientific words were used in the non-scientific contexts, such as “care”, “daily life” and “education”, which was different from traditional scientific informationlike “care”, “daily life”, “education” etc. This indicates that the mass media use the word "brain training" for the primary purpose of serving as a news hook, not making much of scientific correctness. We refer to this type of attitude as "Neta-science"; “Neta" means a story or something buzzed about in Japanese. This is a new form of scientific information which is independent of conventional scientific disciplines which has a dualistic view of science/pseudoscience.

Discrimination of Neta-science from pseudoscience will give us a better understanding of the “brain boom” and the communication gap between neuroscientists and the public. Currently, many scientists criticize the "Brain training" as a pseudoscience. However, if we treat "Brain training" within the framework of true-false binary coding, we may fail to consider the attitude like Neta-science. Criticism on the basis of scientific inaccuracy just causes an answer such as, "It's not science at all, in this context, the primary importance of information is not scientific accuracy."

The concept of Neta-science will bring a new aspect in public communication of neuroscience. Considering the brain boom as Neta-science, it will take a positive role of diffusing neuroscience to the people who don’t have much interest in science. Neta-science may satisfy what the people expect for science. Scientists and mass media should criticize Neta-science when, and only when, it leads to serious confusion and actual harm to individuals. As long as it is harmless, Neta-science can play a useful role in science communication.

Execution of Workshop Form Training Program for Science Communicators

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Abstract. National Museum of Emerging Science and Innovation (Miraikan) has concentrated on the practice of the science communicator's training and has developed some programs. Our programs can incorporate some kind of science communicators (SC), for instance, scientists science teachers postgraduates publicists of research laboratories and staffs of science museums etc. This paper introduces workshop form training program for SC, including some findings from its operations.

We developed and practiced the training program contained the following three features. (1) Short-term training; participants do not interrupt own works. (2) Participant who has various backgrounds; it is possible to discuss it by the diversified aspect based on practice. (3) The lecturers are Miraikan's SC; the professional of the science communication advises. In addition, The SC's abilities are different according to their standpoints and purposes. Then we assumed three abilities, 'Information coordination' 'Presentation' 'Facilitation'. First one is ability to scrutinize information and to add social value second one is expression ability to suit object and third one is ability to promote communications and to make a plan such an opportunity. Our program learns these three viewpoints.

As many as 525 people attended this program between 2005 and 2010. The pilot program had been done in 2005. Having been suggested from the pilot program the request of the participant was the lecturer's existence as the adviser who helped the environment that was able to carry out the discussion of the science communication and to discover the bud of the learning.

Then, we restructured the training program in the workshop form. For instance, one of the programs uses the newspaper article that is controversial one including scientific discovery and the last sentences have disappeared. The participant separates into a small group of about five people, and does three works. In the beginning, they look for 'Social value' from among the article. Next, the group imagines the appearance in the future that the scientific discovery written in the article brings. Finally, they bury the last sentences of the article. Their sense of values knocks against through these works each other. The participant deliberately does the discussion of the essence of the science communication repeatedly through the group work and the lecture. Our problem in the future is to measure whether there is continuance in the effect of the influence that training gave the participant. In addition, we should create the chance that they always improve the ability as a SC.

How Can Academic Professional Communities Contribute Public Relations of Science?

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Abstract. Developments of modern science have multiple aspects of contacting with societies and it arouses many conflicts with lay people. Scientific advancements are rather specialist or technical and are not friendly to be understood by lay people. Cutting edge scientific knowledge is produced by professional specialist belonging to academic institutes and nearly monopolized by them. These situations make the gap between science and public wider despite science nowadays become more powerful and influential to normal people's daily life. Science communications for sharing information on scientific advancements are becoming considerably important.

In 2000s, Japanese governments increase budgets for scientific research besides other outcomes were saved. Under this policy, many attempts for expanding the occasions of science communication have been done because of accountability for tax consuming. Academic institutes such as universities and national research institutes have crucial roles for that, they have extremely enlarged their public relations sections, and the press releases published by them were doubled. Short-termed research budgets program also played a big role for the expansion of science communication activities.

On another front, academic professional societies seemed to have not changed their activities much in comparison to academic institutes or some short-term research programs. Because they do not execute the research by themselves, and the research budget enlargement in the last decade could not make direct influence on them. But without abundant financial back-up, some academic communities have enhanced their activities on the contact points with public. Some academic societies have started science cafes, some started to publish press releases at each annual meeting, and some improved their outreach activities through their websites. Unfortunately, these activities' ameliorations were rather isolated, because interaction between other academic professional communities was not much active. Here I show an overview of Japanese academic professional activities on public understanding or engaging.

Public relation activities on science by academic professional communities have extreme importance. In Japan, most of the new coverage on novel scientific progress is based on the news releases issued by research institutes, not by academic communities. These releases are mainly addressed to mass media especially for newspapers which have specific sectors for science and technology, and the quantities of articles appeared on the newspapers sometimes have a power to persuade bureaucrats for researchers' activities to attain the budgets. Each public relation sections of research institutes have propensities for exaggeration about their own results, because they do not have responsibilities to the field of studies unlike academic professional communities. To enlarge the involvements of these communities on public relations of science make sounder situation.

Making the Most of Other Cultures–Attract People's Attention by "Blending Science": Case Studies in "Kitchen Science"

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Abstract. In these ten years, the importance of science communication has become recognized by governments and scientific communities. Many types of science events are being held every weekend, from lectures, symposium, workshops, public opening of research institutes, to science café, throughout the country, and most of them are organized by scientific institutes or groups related to science. These events attract people, but participants tend to become regular. These events' name are with scientific terms and speakers' name on the leaflets for publicities are only scientists ones. With these strategies, in spite of the flourish of multiple science communication attempts, public awareness and literacy for science are not seemed to be reacted.

There are people who have some interests in science without explosion and even self consciousness. For example, some people have some allergic feelings to the words related to science, but they can eagerly listen to the story with scientific explanation on some daily phenomenon. If approaches of science communication to these kinds of people are successful, public awareness and literacy of science can be improved.

We have planned and executed several noteworthy attempts to evoke sleeping interests in science by "lure-fishing" with cultures other than science. Scientific events like science cafes were planned featuring popular cartoon films, literatures and mythology, traditional performing arts or else. These events succeeded to collect different participants from other 'normal' science events. The names of other cultures worked like 'lure' in fishing. Such "fished" comers for science events seemed to be sometimes rather puzzled by scientific contents of the events, but some satisfied and evoked some interests to science.

We would like to introduce an example of the attempts as "Kitchen Science": the combination cooking and science. The science experiment classroom with cooking is effective for not only children but also parents for awareness of science. These events are successful in showing relation among public living and science & technology. The effective model working for attracting parent-child to science will be discussed.

Green Biotechnology and Genetically Modified Food: Perception and Attitudes of European Politicians and Journalists

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Abstract. With the world population reaching 9 billion in 2050, food production must increase until then by at least 50%. To face this challenge, scientists suggest using all tools available to increase agricultural productivity on existing land including advances in the field of genetically modified crops, food and green biotechnology. Still, previous research has shown skepticism by the general public and the political debate is even more than 15 years after the first introduction of genetically modified crops into Europe in full swing. However, little research has been conducted on opinion leaders and decision makers, such as politicians and journalists who are crucial for NGOs, scientists and industry to advance their agendas and/or products. With a quantitative research approach, attitudes, information sources and trust towards and perspectives for genetically modified crops, food and green biotechnology of European journalists and politicians in comparison to the general public are analyzed. Journalists and politicians proof to be much better informed, but are even more skeptic than the general public in many aspects. Significant differences, but also many similarities between the groups and subgroups could be observed and give impulses to the debate and its stakeholders.

Keywords: Biotechnology, Genetically modified food, genetically modified crops, Eurobarometer

Promoting Science Through Facebook: Characterization of an Audience and Interactions

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Abstract. The use of web-based platforms, such as Facebook, is increasingly widespread, amongst both individuals and organizations. New Media gives you the chance to potentially establish dialogue, build relationships and engage with the public.

Here we want to describe the use of Facebook by a research institute, Instituto Gulbenkian de Ciência, IGC. To our knowledge, IGC was the first research centre in Portugal to use this platform to communicate science, the researchers behind the science and events (scientific and science communication). With a presence at Facebook, IGC aimed to establish a steady flow of information to a wider audience and, furthermore, set a framework for interactive communication. In order to evaluate the impact of this communications strategy we conducted a study to characterize the audience at this platform and the interactions per post and per theme promoted through this media.

Our preliminary analysis extended over a six months period (from December 2009 to May 2010). As a first approach we analysed interactivity based on the use of “Like” button and number of comments. During this time frame 103 messages were posted on IGC Facebook page, which prompted a total of 707 interactions (57 comments and 600 “Like”). We further characterised the audience, when possible, i.e., when the individual profiles had information visible to others. We analysed the geographical location, profession, age and sex of the general “fan” audience and of the subgroup that interacted with IGC page.

We shall discuss our findings within the context of using Facebook as a medium for dialogue and discussion around scientific issues. Further challenges include involving scientists at the research centres in directly communicating their research through social networks. We hope in the future to extend this analysis to other research institutions that also use these platforms in order to analyse the promises and challenges of using social networks to raise awareness of science and promote dialogue.

From Public Awareness to Public Understanding of Science: A Model

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Abstract. Efforts to promote public understanding of science, in an attempt to address science knowledge deficits, have been criticised vehemently. It is maintained, even at this PCST conference for example, that an in depth knowledge about scientific principles is not necessary for the public to interact with science. Communicating science in ways that foster public awareness (i.e. "an appreciation of the way science works", as stated on the PCST website) is regarded, conversely, as a more realistic endeavour. The relative scopes of *awareness* versus *understanding* continue to be debated, where the latter is condemned, because it perpetuates a deficit model, and the former is allied to indefinite actions such as "participation" and "engagement".

Science communication literature suggests, however, a possible interplay between understanding and awareness. For example, the *AEIOU vowel analogy* (i.e. Awareness, Enjoyment, Interest, Opinion-forming and Understanding), defines understanding as a developed comprehension of scientific principles and what those principles imply commonly. In that context, awareness is regarded as a prerequisite for understanding. Another model, the *Personal Awareness of Science and Technology* (i.e. PAST), proposes that it is possible to change individuals' PAST through reflective experiences. It maintains that experiences which inform an individual's PAST, by connecting with previous experiences, can enhance that individual's scientific knowledge.

There is a lack of clarity, from a general science communication perspective, about the exact processes by which audiences progress from awareness to understanding. The roles of engagement and participation complemented by elements of ownership, belonging, enthusiasm and motivation, assume varied interpretations in different science communication models. This poster attempts to bridge this void by offering a model that describes the processes through which audiences' transit from being scientifically aware, to developing comprehensive understandings of science. Engagement, in this context, is defined as active participation where, desirably, both the communicator of scientific information and the audience contribute as well as receive. The ensuing co-production process leads originally to awareness and ultimately to a sustainable scientific knowledge-base, which this poster describes as understanding.

Science Communication in an Applied R&D Institute

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Abstract. Public understanding of science is an important aspect that affects technology development and transfer in the modern society. An astute understanding of science by the public helps easy acceptance and transfer of technology. The relation between technology transfer and public understanding of science is much more intricate in case of public funded R&D organizations. In applied research organizations such as Central Food Technological Research Institute, Mysore, where the research being carried out relates to one of the basic needs and is associated with traditional practices. Not surprisingly, the technology transfer efforts in CFTRI encompass a wide array of public. From knowledgeable large scale processors to the cottage industrialists for whom the technology is tradition handed down through practice, the clientele of CFTRI varies widely. Accordingly, the Institute has adopted varied communication strategies to simulataneously address its clientele. The strategies have used an array of media. In the early days when nutrition awareness was a prime mandate, direct communication through lectures and demonstrations were in extensive use. Over the years as the literacy rate rose, the Institute used print media as a vehicle of communication. Besides press releases, Semi-technical and popular science publications in the form of pamphlets and handouts were published. The Institute also published Food Science, a Popular Science journal, unique in that it was dedicated to a specialized branch of science and was published at a time when general science journals were rare. The journal was published simultaneously in English and two Indian languages to cater to non-English literates. The paper will elaborate with examples on the direct communication strategies and the media approaches adopted for public engagement by the Institute.

Science Communication through Geospatial Technologies and Mass Media in India

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Abstract. Science Communication through judicious use of geo-spatial technologies and mass media without following specific boundaries is an important concept for dissemination of scientific knowledge to the socio-economic wellbeing of society, although such concept is still an undeveloped field of study that requires a lot of further research and development.

In Indian conditions, where participatory democracy, plays a dominant role, such concept have high relevance. The sensible application of geospatial technologies and mass media in communication of scientific ideas and disseminating technological knowhow which shapes human life can go a long way in increasing human abilities to respond to technical issues and problems that pervade daily human lives. However, it would be desirable if, any national approach is compared with different other countries too, to understand, local, regional, national and global similarities and differences.

Geospatial technologies like mobile GIS and GPS, can trigger and sustain public interest in S&T, by playing important roles in situations such as disaster management that requires precise and reliable scientific information about the current situation on the tragedy mitigation of which needed urgent and sensitive spatial information i.e. location of the current state of calamity with in minimum waste of time and thereby allowing to manage it in a better way.

The present paper discusses various aspects of science communication through judicious use of geo-spatial technologies and mass media in Indian conditions. Since India is an emerging economy, its approaches indicate many new ways of thinking and putting ideas into practice, thus it is of much relevance to share such experiences and works with different cultures. The paper in hand also focuses on issues like scientific temper and review of studies covering public attitudes and cross-cultural mapping of public engagement of science.

Role of Tocklai's Science Exhibitions and Workshops in Educating Common People and Student Community on Health Benefits and Scientific Upbringing of Tea–A Case Study

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Abstract. Role of exhibition in educating and creating science awareness among student and common people is well recognized. It forms a platform where visitors get ample opportunity to express views and can exchange ideas with experts of relevant fields. Tocklai Experimental Station commonly known as Tocklai was established in the year 1911. Ever since its inception Tocklai promotes R & D in tea and has been serving Tea Industry of North East India and the contribution of Tocklai towards the growth of tea Industry of North East India is well documented. Tocklai has developed 185 new tea cultivars which have been widely used by planters. Agro-technology that have been evolved after a series of experiments are currently used by planters for scientific up upbringing of tea plants, pruning, plucking, manuring, pest control. Tea processing machineries developed by Tocklai are being used not only by planters in India but also used by planters of other tea growing countries of the world. Process optimization for quality tea production is an applied and practical science which has been accomplished with the establishment of model tea factory in 2004. Hosting of science exhibition is a tradition of Tocklai where all aspects of tea growing, tea manufacturing, tea tasting, pest control measures, identification of natural enemies of pests, including beautifully preserved butterflies of Tocklai museum, different grades of tea are displayed. Health benefits of tea are well displayed in the form of posters. Tocklai has also have a publication i.e official scientific journal,Annual Reports, Quarterly news letter, Tocklai news letter, Memorandum, Field management book etc for growers. Students from schools and colleges pay regular visits to Tocklai and interact with scientists, experts to know the basics of life science with special reference to tea. This paper evaluates a few national exhibitions attended by Tocklai and the knowledge that reached the tea grower, students and common people in respect of tea growing and its consumption.

A Study on the Correlation Between School Students' Creative Imagination and Their Personality and Peer Relationship

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Abstract. This study examined the correlation between school student's creative imagination and their personality and peer relationship. It assessed 70 students regarding their creative imagination and self report. Based on the findings of this study, it concluded that students' personality characteristics with more creative imagination are: (1) Like to work or play with others; (2) Usually have many ideas of interesting things to do for fun; (3) Enjoy drawing or painting; (4) Like to be first try something new; (5) Like singing or dancing with friends. Furthermore, peer relationship has an important impact upon the personality characteristics of the students with creative imagination.

Communicating Science with Respect for Water Culture: A Case Study on Thai and Laos Water Cultures

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Abstract. From the past till present, life styles of local communities, traditional characteristics and cultural landscape in the region of Thailand and Laos are water based and forming so-called 'Water Culture'. These water cultures are reflected in their local daily lives, proverbs, metaphors, rites, rituals and traditions. The researcher investigates the matter of cultural/ natural/ environmental conservation on the Science Communication perspective using documents, interviews and dialogues with communities. This study finds that Science Communication activities could be achieved with respect for Water Cultures of the region. Mutual learning enhances good relationship and profound understanding of Water Cultures of Thai and Laos people which show similarities and differences. Local Wisdom concerning Water Culture is actually operational or problem solving knowledge that keep local communities living in harmony with respect to one another and to nature as well as super natural beings. Strategically, it can be the foundation for natural and environmental conservation efforts amidst changes brought by modern development. New operational knowledge is derived from the co-creation between science & technology and local wisdom. Examples of such efforts are explained and shown in the poster session.

Science Communication as an Integral Part of Effective Research Management in Higher Education Institutions in South Africa

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Abstract. As a developing country, South Africa relies heavily on its higher education system to produce knowledge that can be applied to address the needs of its society. In its Research and Development Strategy (2003), the South African Government places emphasis on the important contribution the research has to improve the well-being of its people. Furthermore, research has an important contribution to make to evidence-based policy formulation in a developing country like South Africa.

This poster will show how science communication, as an integral part of effective research management in Higher Education Institutions (HEIs) can assist to create opportunities for researchers in South Africa to do relevant and applicable research that will have an impact on policy formation and contributes to the concept of science for society, while maintaining the academic imperatives of excellence and quality.

Public interest in science is growing in South Africa and the media can play an enormous role in showcasing the competitive edge of institutions. Although this function normally lies within marketing and communication divisions within universities, research management offices have to realize that to stay competitive and effectively support research activities, they have to not only provide up to date statistics and information on research outputs, for example, but they have to also play a role in disseminating research results to different stakeholders such as possible future collaborators, funders, postgraduate students and overseas investors.

It has therefore become more and more important for research managers to include in their strategy an element of science communication. Stellenbosch University, one of the leading research-driven universities in South Africa, is presented here as a case study to demonstrate how science communication, as part of a coherent research management strategy can provide new directions for the development of research and research-related activities. The poster will show how science communication feeds into the core elements of this strategy, namely (i) the introduction of strategic research themes; (ii) facilitating effective networking across disciplinary boundaries; (iii) research capacity building; (iv) maximizing research funding opportunities and (v) creative marketing.

Intellectual Property on Knowledge Based Content: Challenges to Science Communication

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Abstract. The academic and research field is always under pressure because copyright is at the core of Intellectual Property (IP) and exist different opinions on the enforcement (or not) of rights owners on the new digital products. Educational institutions and educational publishers implement digital platforms to make the different educational content (eContent) available. These materials are made available through web content systems that implement the necessary access control mechanisms that give access to the platform or to content. This is the typical scenario. However, after the content has been released from the platform perimeter (after a successful access control authentication), the control over the content usage distribution and modification generally don't exist.
In academic field "fair use" - law that permits limited uses and reproduction of copyrighted materials without the owner's permission like use of a work for scientific or teaching purposes - is the current and commonly accepted doctrine but sometimes is misunderstood and author rights are not easily respected. Fair use is the safety valve of copyright because without it, copyrights foundational propose to promote learning, advance knowledge, and the progress of science would be useless.
eContent IP rights are also a property right which means the owner can assert to third parties it and transfer rights to others creating a complex layer of rights that sometimes could conflict. Relationships among them are depicted below:

At academic institutions the most basic right which most people wants to preserve is the right of attribution. And to preserve that when other people reuse content we must do one thing: references of the original author by citrating him. There are currently some technological measures that are able to enforce appropriate rights management mechanisms. However, these rights management measures are controversial and the application of these systems has to ponder the complex and contradictory pros and cons of such solutions. This usually results in two very different directions: the open access movement approach and the rights protection and management approach. In this paper, some eContent usage scenarios on science communication, eContent lifecycle steps and stages and some important issues concerning intellectual property like usage privacy and the factors that affect both of the above mentioned directions are presented. Also, the paper identifies, describes and discusses the implications and impact the usage of rights management solutions/technologies could have in some academic sectors that have an important role on science/knowledge communication like academic administrative activities, e-education and digital content libraries.

Keywords: Science communication, DRM technologies, Intellectual property of knowledge, IPR, security, ITC education

Green Alternatives for Malaria Control and Integrated Pest Management

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Abstract. The quest to make human less attractive to mosquitoes has fuelled decades of scientific research on mosquitoes behaviour and control. They interfere with the work and spoil hours of leisure time. Mosquitoes also transmit diseases such as malaria, filarisis and many other viral diseases like yellow fever, Japanese encephalitis etc. The strategies for reducing the mosquito borne diseases have been to pronged, centring around habitat control and the use of personal protection in the form of insect repellents.

Most commonly used synthetic mosquito repellent available in the market is based on DEET (N,N-diethyl- 3- methyl benzamide). Although synthetic repellents provide better protection against mosquito bites yet their toxicity, non-biodegradability, unpleasant odour etc., makes them less attractive compared to those of repellents from herbal origin. Various essential oils have been reported to have repellent activity against mosquitoes. Azadirachta Indica A. Juss., commonly known as neem in India, produces seeds which can be extracted to get neem seed oil (NSO). NSO has been used in various insecticidal and medicinal preparations. It can also be used for mosquito repellent purposes. Reports regarding the use of NSO as mosquito repellent are available in the literature. However, most of the studies addressed to the use of NSO in conjunction with coconut oil or mustard oil. There is enough scope to further work in this area. Controlled release by microencapulation is one of the way to improve further the effectivity of NSO as mosquito repellent.

Some entomologists now conclude that neem has such remarkable powers for controlling insects that it will usher in a new era in safe, natural pesticides. Extracts from its extremely bitter seeds and leaves may, in fact, be the ideal insecticides: they attack many pestiferous species; they seem to leave people, animals, and beneficial insects unharmed; they are biodegradable; and they appear unlikely to quickly lose their potency to a build up of genetic resistance in the pests. All in all, neem seems likely to provide nontoxic and long-lived replacements for some of today's most suspect synthetic pesticides.

The present review emphasizes on the potential efficacy of neem seed oil as an effective natural pesticide as well as mosquito repellent and larvicide and aims at to create awareness among the people towards greener alternatives.

A New Data Mining Model for Cancer Classification with Minimum Gene Features

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Abstract. In the past decade, bioinformatics has been a fast growing research field in health sector due to the advent of microarray technology. Amongst many active microarray researches, gene expression microarray classification has been a hot topic in recent years and attracted the attention of many researchers from different research fields such as data mining, machine learning, and statistics.

Gene expression data analysis plays a vital role in medical diagnosis and drug discovery. With huge volume of gene expression data, the possibilities of cancer classification have to be explored. Many methods have been proposed with promising results. Various statistical gene selection techniques, which are an integral pre-processing step for classification along with few supervised classification methods, were used in various works. The initiation of efficient classification algorithm for cancer gene expression data has been exploded in health sector during recent years. Particular application of Data mining algorithms for microarray technologies is in cancer research with a goal of early diagnosis of cancer. In machine learning community, supervised learning is to build predictive models using gene expression measurements of a number of individuals with known class membership.

This paper presents a new and novel supervised classification method for cancer classification and prediction. The proposed framework uses four stages in classifying and predicting future outcomes:

1. The first stage , pre-processing the database such as random division of the database for training and testing, noise removal, missing data estimation, individual feature(gene) ranking was proposed.
2. In the second stage all possible subsets of features were generated and ranking features pair wise.
3. In the third stage, all important gene pairs which achieved zero error in training using the best classifier were extracted.
4. Finally the fourth step classification and prediction.

This work found to be efficient in reducing the number of genes that can best predict the type of cancer with reduced complexity and computational burden.

Keywords: Microarray, Classification, Prediction, Gene expression

Community Participation in Ecoschools for Sustainable Environment from Cuddalore District of Tamil Nadu, India

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Abstract. In these days of environmental crisis there is a need to increase people's sensitivity to and involvement in, finding solutions for environment and development problems. Education can give people the environmental and ethical awareness, attitudes and values, skills and behavior needed for sustainable development. Even though adequate concepts on environmental concerns have been incorporated in the textbook of all subjects right from first standard, teachers are unable to infuse effectively in their teaching learning process. As a result, the children are deprived of environmental ethics and consequently when they become adult citizens they resort to destructive activities on the environment. After realizing the need for promoting knowledge along with attitudes, values and skills among teachers and students on environmental concerns ecoschools have been established. The present study which was carried out by involving 120 members of the community from 10 of the 50 elementary ecoschools developed in Cuddalore district of Tamil Nadu from July 2008 to March 2009 focuses on the need for participation of members of the community in improving the performance of the ecoschools for sustainable environment. The knowledge, attitudes, practices, and performances of the members of the community were evaluated by administering tools namely "questionnaire", "attitude scale", "application inventory" and "rating scale", respectively. The "questionnaire" and "attitude scale" consisted of 20 questions and statements, respectively under four dimensions namely "biology", "water resources", "pollution" and "hygiene and sanitation". The "application inventory" and "rating scale" comprised of four statements each. The grand mean knowledge score of the community recorded in the pre-test was 78.86%. The grand mean knowledge score registered in the post-test was 92.39%–an increase of 13.53 percentage points over the pre-test score. While the grand mean attitude score registered in the pre-test was 94.07%, the grand mean attitude score in the post-test was 4.14 percentage points higher than the pre-test score. The grand mean rating score recorded was only 36.87%. A wide variation among the various aspects of practices and performance was recorded. Even though the members of the community is known to possess higher level of knowledge about and attitude towards the environment the existing wide gap between the practices and performance needs to be narrowed down to enable them involve with more commitment in improving the physical environment of the schools and villages.

Spectroscopy in UV-VISand IR Region in Different Environment

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Abstract. Photophysical process is ubiquitous in nature, playing a key role in the light harvestingmachinery of photosynthesis, where hundreds of special antennae molecules are used to collect lightand transfer the absorbed energy towards reaction centers where charge separation occurs. Thiswork is an effort to explain the study of environment effects on the energy transfer. The study has its special interest on the use of different spectroscopic tools working in UV-VIS and IR region to identify intra/intermolecular charge transfer photophysics of different compounds which are active DNA bases which will be easily understandable to all.

Introduction

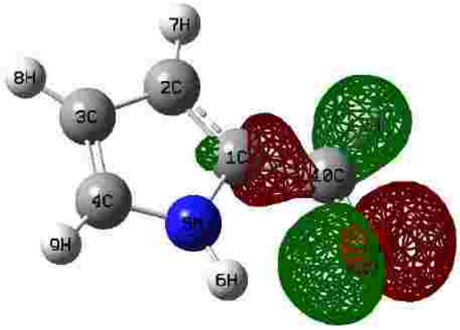
Among different hydrogen bonds, the O-H…O and N-H…O bonds most oftenoccur in liquid phase. It plays a crucial role in biological systems such as proteins and DNA basepairs and is essential for life processes. In all hydrogen bonded molecules there is a strongpossibility of solute and solvent interaction. There is a lot of studies deal with these interactions toexplain their nature, strength and other features important for physical, chemical, and biologicalprocesses such as proton transfer reaction, molecular association in solutions etc. Proton transferspectroscopy ground and excited state reaction dynamics of N-heterocyclic [1,2] is an interestingand developing subject area of research especially for the molecules containing more than one functional group.

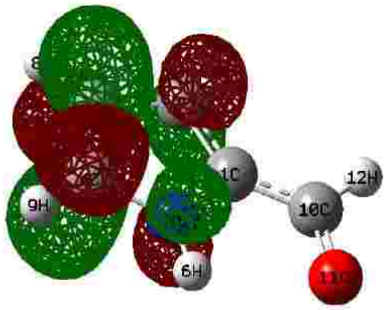
Methods

Absorption and emission spectrum in mid IR and uv-vis region reflects features of allmolecules as a whole. This fact suggests that the coupling of *ab initio* calculations [3] of vibrationalmodes and mid-IR spectroscopic measurements may be another powerful tool for studying the structural properties of Pyrrole-2-Carboxyldehyde (PCL), Pyrrole-2-Carboxylic acid and its related compounds. The intramolecular redistribution of electronic charge due to photonicexcitation induces the ESIPT process which is ultrafast in nature [4].

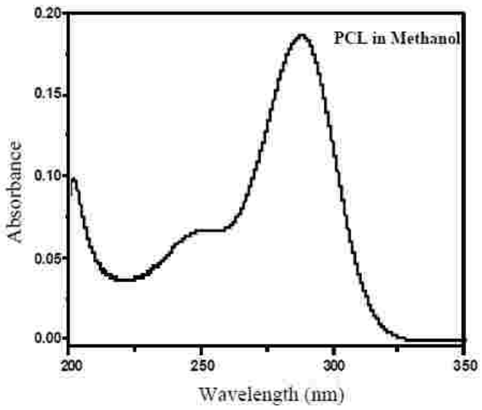
Results & Discussion

The absorption spectra of PCA in different solvent point the presence of intramolecularly hydrogen bonded closed conformer in the form of 280 nm band. Stokes shiftedfluorescence of PCA at 310 nm in hydrocarbon solvent and hydroxylic solvents have been identified to be due to normal molecule. Variation of pH results enhancement or decrease ofemission from ionic conformer with parallel dwindling of emission of neutral species.Theoretical and experimental ground state and excited state behavior of PCLand its related compounds were investigated in UV-VIS and mid IR region of electromagneticspectrum. We have measured the spectrum of PCL in the UV-VIS region ranging from 190 nm to 900 nm and in IR region ranging from 450 cm^{-1} to 4400 cm^{-1}. Possible origins of dominant absorptionbands have been assigned successfully with ab ignition HF and DFT calculations taking the effectsof hydrogen bonds in account in the IR region. Possibility of intramolecular and intermolecular hydrogen bonding of PCL in ground state was established theoretically by the distance N5-H6………O11 of acidic and basic moieties of PCL and experimentally it is verified by the IR stretching and bending mode vibrations of different parts of the molecule [5]. The possibility oftransfer of hydrogen from pyrrole ring towards formyl ring in excited state indicates in the light of difference in bond length and bond angle, dipole moment, enthalpy, Gibbs free energy etc and with fluorescence and phosphorescence spectrum in the excited state of the molecule. The absorption maximum and oscillator strength computed from HF (RHF, UHF), DFT calculations for gas phase, nonpolar medium, polar medium agrees reasonably well with experimentally measured data. We consider that the experimental and theoretical results presented here are useful for studying theelectronic and vibrational properties of different olefins.

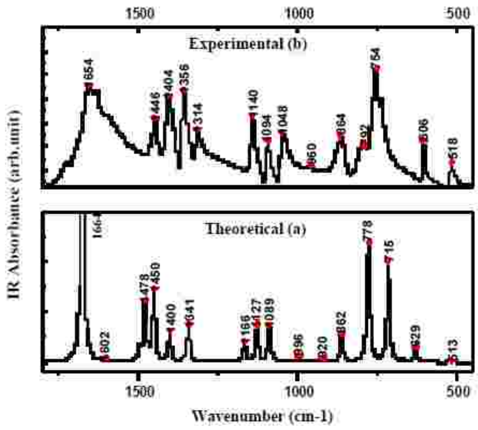




Homo (PCL) Lumo



UV-VIS absorption spectra of PCL in MeOH.



IR absorption spectra of PCL in KBr pellets.

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Relations of Food Habits and Skin Diseases: Eczema

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Eczema is a broad clinical term that embraces number of pathological different conditions characterized by red, papulovescicular; oozing and crusted lesions at early stage and with persistence eventuate into raised, scaling plaques. Eczema has acute phase, which if untreated goes into chronic eruptions, histipathological features are same of all these conditions but clinically we can classify into following categories as:

- Atopic dermatitis
- Allergic contact and irritant contact dermatitis
- Dyshidrotic eczema
- Nummular eczema
- Lichen simplex chronicus
- Asteatotic eczema
- Seborrheic eczema

Thus primary lesions may include papules, erythematous macules and vesicles, which can coalesce to form patches and plaques. In severe eczema secondary lesions from infection or excoriation marked by weeping and crusting may predominate. Long standing dermatitis is often dry and is characterized by thickened, scaling skin that is also called as linchenification of skin (Acanthosis).

Atopic eczema: It is cutaneous expression of atopic state. It is characterized by family history of asthma, hay fever, or dermatitis in up to 70% of patients. It is usually polymorphous on body site sharply defined scaly plaques with or without inflammation, which may be associated with hair loss. It is prevalent mostly in Norwegian children up to 23%. There is clear genetic predisposition. If both parents are affected, then over 80% of their children manifest the disease. When only one of the parents is affected, then 50% of children get disease. These patients display variety of immunoregulatory abnormalities like increased IgE synthesis, increased specific IgE to foods, aeroallergens, bacteria and bacterial products. The atopic eczema characterized by weeping inflammatory patches and crusted plaques that occur on face, back of neck, extensor surfaces of extremities, groin. In adults pattern is usually seen as localized type. Pruritus is predominant characteristic of atopic eczema. Usually findings are secondary to rubbing or scratching. Present therapy approves treatment with anti-histaminic, anti-pruritic drugs, systemic steroids, local steroids are freely advocated. It is very difficult to detect allergen in particular patient, because of which treating him becomes difficult with present anti-eczematous treatment. Still it has not succeeded in curing atopic eczema definitely.

Contact dermatitis: It is an inflammatory process caused by exogenous agent or agent that directly or indirectly injures skin. If the injury is caused by inherent characteristic of compound, it is called as allergic contact dermatitis. Phytodermatitis or plant dermatitis examples are Rhus family plants, Ivy poison, Oak poison, Sumac etc. If irritating agent causes the injury, it is called as Irritant contact dermatitis. Examples are acid contact of skin, silk cloths, and foam leather footwear’s etc. So in ACD if offending agent is identified, confirmed and removed, irruption will resolve. Identification of allergen is difficult. Treatment is based on application of topical medicaments and oral medications. Common sensitizers like nickel Sulphate, potassium dichromate, thimerosal in ocular preparations, neomycin Sulphate, fragrances, formaldehyde and rubber-curing agents are used. Systemic steroids are used freely to treat ACD. Treating infection, use of topical glucocorticoids, cool moist compressors plays no role in treating disease entity. However all these treatments have their limitations?

Nummular eczema: It is characterized by circular or oval eruption, consists of edematous papules that become crusted and scaly predominantly seen over trunk, extensor surfaces of extremities or dorsum of hands and legs. It is also known as Tinea Pedis. Treatment is like above mentioned, but still it has its limitations.

Lichen simplex chronicus: It represents end stage of pruritic and eczematous disorders. It consists of well-circumscribed plaques with Linchenified or thickened skin due to chronic scratching or rubbing. Treatment is to break chronic itching that mainly occurs at sleep. High potency topical glucocorticoids along with antihistamines (hydroxyzine, tricyclic antidepressants-doxepin etc.) are mainly used to treat this disorder. Still all these treatment has its limitations.

Asteatotic eczema: It is known as xerotic eczema or winter eczema is mildly inflammatory dermatitis seen over lower 1/3 of both legs. Fine cracks with or without erythema develop on anterior surfaces of lower extremities. It responds to avoidance of irritants, rehydration of skin, and application of topical emollients. But it has its limitations.

Stasis dermatitis: It develops on lower extremities secondary to venous incompetence and chronic edema. Typically involves medial aspect of ankles. As dermatitis progresses, skin becomes progressively pigmented due to chronic erythrocyte extravasations leading to cutaneous hemosiderin deposition. Chronic stasis dermatitis is associated with fibrosis, known as brawny edema of the skin. It is complicated by infection and contact dermatitis. Severe stasis dermatitis may cause stasis ulcers. Treatment has limitation and use of topical applications and compression stockings with 30mm of Hg pressure are beneficial to certain extent. Also elevation of affected foot while sitting or in sleep helps in decreasing edema. However it has also its limitations. Surgical intervention by plastic surgery is best treatment.

Seborrheic eczema: It is a chronic common disorder characterized by greasy scales overlying erythematous patches or plaques. It is prominently seen on scalp and it also called as dandruff. It is also seen on eyebrows, eyelids, labella, nasolabial fold or ears. Treatment is use of low potency glucocorticoids along with shampoo. But it has its limitations; because it does not give easy feeling (sensation) to patients and patients repeatedly feels to scratch his scalp.

Pathogenecity: In acute stage, there is formation of red, papulovescicular, oozing, crusted lesion. These lesions are prone for super infection. And itching its characteristic worsens this disease process. As time lapses, lesion becomes dry and skin starts becoming Hyper keratinized.

Eczema is a chronic granulomatous skin disorder (CGD) affects skin as well as lung, lymph nodes, liver, bones. Chronic Granulomatous Disorder is characterized by impaired host defense against microorganisms. Immunoglobulin levels may be elevated or normal. Delayed hypersensitivity is impaired. Leucocytosis with increase in proportion of neutrophils is characteristic of CGD. Neutrophils do not kill those microorganisms generally found in the lesion, but kills staphylococci, lactobacilli, pneumococci. Microbicidal defect is mainly due to decrease in Phagocytosis, which eventually induce metabolic burst. So decrease in oxygen supply, H_2O_2 deficiency and bacterial & fungal resistance to existent available drugs are main causes of this disease process. It can be revealed by presence of microorganisms, fungi, biopsy, Leucocytosis, raised neutrophils count. Others like KOH preparation, Tzanck smear, Diascopy, Patch test is useful in diagnosis of this entity. Thus decrease in oxygen supply and decrease in hydrogen peroxide in subcutaneous tissue are main cause of decrease in Phagocytosis. Staphylococcus aureus, certain gram-negative bacteria, fungi are predominant pathogens. As neutrophils fail to kill all microorganisms and there is influx of polymorphonuclear leucocytes with abscess formation, which is a feature, with central necrosis, surrounded by numerous plasma cells, lymphocytes, macrophages characterized by yellow lipid material. Diagnosis can be done by increase in neutrophils count and presence of microorganisms.

Microbiological explanation: The main characteristic of acute eczematous lesion is accumulation of edema fluid in epidermis (spongiosis). In urticaria edema is localized to perivascular spaces of superficial epidermis. In spongiotic dermatitis edema seeps down to intracellular spaces of epidermis, splaying apart keratinocytes located primarily in stratum spongiosum. Thus intracellular bridges become prominent giving spongy appearance to epidermis. So mechanical shearing of intracellular spaces and cell membrane progressively accumulates fluid in formation of intraepidermal vesicles. Therefore during earliest stages of spongiotic dermatitis, there is superficial perivascular lymphocytic infiltrates associated with papillary dermal edema and mast cell deregulations. Thus spongiotic dermatitis resulting from drugs (Sulpha drugs, Chlorpropamide, Methyldopa, Ampicillin, Amoxycillin, Oral contraceptives, Penicillin, Tetracycline, Chloroquine, Phenylbutazone, Proxyvon-group of drugs) will show lymphocytic infiltrates often containing eosinophils and extends around superficial and deep vessels and as the time passes spongiotic dermatitis may subside giving rise to progressive epidermal hyperplasia with hyperkeratosis and parakeratosis.

Facts as patients reciprocate to anti-eczematous treatment: As we think of eczematous skin disease, a picture of person scratching his skin is usually seen. People never take this disease very seriously at least in India, unless it harms their daily routine work. This confirms that attitude and approach of patients to get cure from this skin disease is very minimal. The main cause of avoiding to take treatment for eczema is failure of any method of treating disease entity to cure this chronic eczematous skin disease process. So this eczema is also called as neglected disease by society. This is mainly because of failure of drugs to cure this disease process. The failure is mainly due to:

- Drug resistance
- Cutaneous atrophy
- Incurable itching
- Inability to enhance Phagocytosis

It means inability to kill all pathogens causing this disease. Also all these eczemas are tension related. Thus present anti-eczematous drug fail to bring an end to pathogenecity of chronic eczematous skin disease process. Basically staphylococcus aureus and certain gram-negative bacteria along with certain fungi are strongly resistant to available allopathic anti-eczematous skin disease process. Now facts regarding my invented Yashoderm are given underneath:

- The process of mixture is meant for external use only.
- The solvent in this process is universal solvent (water).
- The process according to the claim wherein the reaction is carried out in solvent within skin layers is inert under reaction condition.
- As per claim this reaction is carried out at any room (atmospheric) temperature.
- The process according to the claim wherein reactants formed are nascent oxygen, hydrogen peroxide along with excess of chlorine and excess of hydrochloric acid formed plays major role in enhancing phagocytosis.
- As per claim the composition of chemicals have good physical and chemical stability.

Goals or objects of my invention: -

- First stop chronic itching.
- Demolish Linchenified (Hyperkeratotic [Acanthosis]) and make the skin totally normal by medication only and ultimately remove ugliness of skin.
- It must be affordable to any patient.
- To find ultimate remedy to cure any type of eczema.
- Patient must get cured in shortest duration of period without inducing extra tension of regularity of taking number of drugs to these patients.
- Cures dandruff (Seborrheic eczema) most effectively.

The said process is only for external use and solvent used is water. The drug must be kept in non-humid place, out of reach of children. The said process composition must be kept in dark tan glass bottle or thick black plastic container with tight cover and drying agent (dehydrating agent) like silica gel rapped in polyethylene bag (synthetic paper) or cotton bag is kept in a special socket made from inside of cap or cover having holes at its bottom to absorb water molecules present in container.

Before bathing and / or at night before sleeping appropriate quantity of mixture (1 to 1.5 grams) is taken in saucer or glass container. Never use stainless steel vessel, because drug reacts with the same and stainless steel vessel will get spoiled (damaged). Then wet eczema skin with water, so drug must be applied on wet skin only. Then add at least ten milliliters of water to drug taken in saucer. As we add water to drug, all active ingredients get dissolved in water and what remains behind is residue of calcium hydroxide. So mix it with hand only and immediately apply prepared liquid drug by hand only on eczema skin and rub area with ordinary stone or turf of coconut hair by applying tolerable pressure for two minutes. This process of rubbing must be delicately done most seriously, because the active ingredients of drug get percolated deep in to the skin and there by kills all microorganisms and fungi present in that area causing this chronic eczematous skin disease process most effectively. Then wash skin with fresh water. So simple is my procedure. Then immediately bathe yourself and you can use any soap for bathing; but after bathing, not a single particle of drug should remain on skin. If it exists, wipe it under running water or clean with wet cotton. All eczema patients must reduce use of soap unnecessarily quite often in a day, because saprophytic bacteria present on skin that protects skin from exogenous agent like bacteria or fungi.

In the above described process, to get synergistic effect, one can give injection of triamcinolone acetonide intramuscularly once in a month. This way the patient gets cured of their disease very fast. In the above-described process reactants formed are utmost essential to enhance phagocytosis in eczema. These reactants get percolated in dermal layers and stops itching, removes acanthotic skin, kills all microorganisms and fungi by its highly potent action and by correcting leukocyte metabolic activity; ultimately cures chronic eczematous skin disease process. The excess of active agent forms plays subordinate role in removing or abolishing linchenified skin of eczema and finally brings an end to chronic eczematous skin disease process.

Psoriasis is very obstinate, obscure chronic skin disease seen in human beings. There are eight types of psoriasis. They are as follows:

i. Plaque psoriasis: It is most prevalent form of disorder characterized by raised inflamed scaly lesions. Dead skin cells form scales while inflammation is result of increased blood supply to areas of rapid cell production.
ii. Pustular psoriasis: It is characterized by pustules on skin. It has three distinct phases as reddening of skin, formation of pustules and scaling of skin.
iii. Guttate psoriasis: It produces small red-drop like lesions accompanied by scaling. It can be triggered by strep’s throat or upper respiratory infections, chicken pox, physical trauma, illness by anti-malarial drugs.
iv. Inverse psoriasis: It mainly affects skin folds characterized by smooth red inflamed lesion without scaling often irritated by rubbing or by sweat.
v. Erythrodermic psoriasis: It is characterized by inflammation all over body with swelling, pain and itching.
vi. Scalp psoriasis: About half of psoriasis has scalp psoriasis characterized by heavy scaly skin with itching irritated by sweat or irritation.
vii. Nail psoriasis: It mainly affects toe nails. Nails become thick, pitted and often yellowish in color.
viii. Psoriasis arthritis: it causes inflammation and swelling of finger’s joints, feet, knees, hips, elbows. About 10% of psoriatic patients develop psoriatic arthritis.

Psoriatic patient must avoid following food articles.

1. Fruits: Mango, Banana, Chikoo, Papaya, Pine apples, Jackfruits
2. Diet: Strictly abandon non-vegetarian food products of any kind
3. Munching items: Abstain Nagali’s or Udid’s papad if they are made with papadkhar (a type of salt). If one prepares Nagali’s and Udid’s papad without making use of papadkhar; it can be indulged. Rice papad is allowed to indulge. Abstain Mango pickle but you can eat lime, chilly and myrobalan pickles. One can eat potato chips, Sago papad, Chakali made out of Sago and potato mixture with chilly powder, garlic. Wheat’s kurdai can be indulged. However any oil-fried products must have very limitations.
4. Habits: No habits are allowed. Patient must be non-habitant.
5. Oils: Groundnut oil or use of complete groundnut or crushed groundnut in vegetables or any food products must be avoided. Person can use sunflower oil, soybean’s oil, safflower oil or palm oil for preparing food.
6. Masala: Garam Masala is not allowed. Person can prepare all foods in red chilly powder only. One can eat green or red chilly.
7. Vegetables: brinjals, cluster beans, drumsticks, coriander leaves or coriander, ginger must be abstained.
8. Milk and its products: Any plain milk without cream must be indulged. Cream is abstained. Milk sweets are allowed but curd, buttermilk, sugar added buttermilk, kadhi, shrikhand are not allowed. Ice-cream prepared from custard powder, milk, sugar but without cream can be indulged. Ice-cream with cream is not allowed.
9. Nuts: gram nut and its all food products must be avoided. We prepare pithle, dhokale, bhaji, potato wada (one can eat potato but potato wada must be avoided), we soak gram nut, mung and math in water. Then we tie the same in simple cotton cloth for one day. It germinates and then we prepare vegetable out of the same. So math, mung can be indulged but gram nut must be avoided, we prepare wade’s vegetable, puranpoli, shev, chivda, farsan, fafada, bundi’s ladu,

mysore-pak cake, kate-shev, chana-batura.all these products are made out of gram nut. So they must be avoided. Use of white udad nut must be restricted.

10. Salt: Never eat excess of salt. Whatever salt is added while preparing food can be indulged. Some people have habit of eating excess of salt, which is not allowed.
11. Soap: Use of soap is not allowed. One must bathe with shikakai, utana or bajara's floor. Psoriatic patients must avoid washing clothes. Contact with any type of soap is not allowed. Women must use disposable napkins when they are having periods (menses). Also men must shave without use of cream. Just apply Luke-warm water over beard area and have shave. After-shave spray or liquid are not allowed. Alum or dettol can be used to wipe bearded area.
12. Cosmetics: Scents, perfumes are not allowed. One can use face powder, talc powder, no nail polish. Please no bleaching of face or facial procedures.
13. Dry fruits: Most of dry fruits must be avoided. Even dry coconut is not to be indulged. Cashew, clove, cinnamon, almond, walnut, a date, a dried date, godambi, coriander nut must be absolutely avoided. Fennel, a currant (dry grapes), charoli cab be indulged.
14. Bakery products: Toast, soft bread, ban can be indulged. No other bakery products are allowed. Ordinary glucose, Marie biscuits can be indulged. Cream-biscuits are not allowed. All cold-drinks can be indulged. Mixed-fruit jam can be indulged at times.
15. Miscellaneous: Magi noodles, Chinese noodles in red chilly can be indulged. One can make use of any sauce, *chatnies* without crushed groundnut. Certain allopathic drugs are promptly avoided in these patients.

They are as follows:

a. Avoided quinine group of drugs like Chloroquine, primaquine and quinine.
b. Avoid Proxyvon group of drugs like spamoproxyvon and butaproxyvon.
c. Avoid Ibuprofen group of drugs like combiflam, anaflam etc.
d. Avoid chlorpromazine and other sedatives.
e. Avoid all anti-arthritic drugs.
f. Avoid salicilates like disprin, lithium carbonate, iodides, nystatin, and anti-hypertensive beta-blockers.
g. Avoid sulpha drugs.

All the above mentioned factors disable equilibrium of human body. In our body every organ has fixed Ph. The whole body is maintained normally at equilibrium. If acidity of body increases, person is likely to get intracranial haemorrhage, strokes, infarcts, ischemic heart diseases. If the basicity of body increases person's immune response goes down (ability to fight against different diseases) and atmospheric bacteria, fungi or viruses attack on body and patient becomes sick due to infectious diseases. I have developed *Suswasthya Churna* that brings body to equilibrium and person becomes normal. Its outstanding properties are given underneath:

i. It is best drug against acidity (acid-peptic diseases {APD}), Chronic constipation, has ability to stop most abnormal activities of our body.
ii. Promptly helps in reducing weight by dissolving excess of accumulated body fat.
iii. At puberty, there are hormonal changes and most of people become victim of acne and body heat. My *Suswasthya Churna* corrects and cures acne by destroying harmful effects of changes that had affected body due to hormonal changes at puberty.
iv. *Suswasthya Churna* affects human Psychology and most of these patient feels comfortable due to loss of lethargy, uneasiness, easy fatigability. People indulging *Suswasthya Churna* will certainly feel fresh, normal and tidy.
v. It has been experienced by regular follow-up study in more than one thousand cases that, it has no side-effects at all and helps in curing all chronic skin disorders, chronic APD, chronic constipation, UTI. It has also been found beneficial in people suffering from chronic arthritis. I recommend its use by every person suffering with chronic disorders. It does not have any side effects and it is always helpful in some ways to distorted body.

Science Communication for the Rural People: A Survey

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Abstract. More than 70% of India`s population resides in rural areas. Majority of rural population in India carries out subsistence farming. The average rural Indian farmer is either illiterate or semi-literate, and if literate, even then cant communicate in English. Latest and advanced information related to market prices, weather forecasts, quality of land, pests control and crop management is vital for professional growth of farmers. Most small scale farmers are dependent on mediators for agro-based information and lack direct and immediate access to it, due to lack of infrastructure and low income.

In our present work, we conducted a survey of farmers and found that farmers often get swindled or misled because of dependency on some malicious and pretentious mediators. They do not have access to the internet, however communication means like radio, television and mobile phones have widely penetrated the rural areas. From our analysis, we analyzed certain prerequisites that are essential for effective information channel for the farmers. The details will be presented in the presentation.

Constructive Framework for Effective Science Communication

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Abstract. It is fundamental that feed-back be given to any communication and the effectiveness be analyzed. Important perception of science communication is that the information is exchanged in order to share the information. Based on effective science communication, present investigation focuses on the research on instructional effectiveness of science teaching apart from traditional methods. Great amount of learning materials through multimedia instructional system can be reused by many individuals, providing that there exists an effective way of finding and disseminating this material. A new concept, a unit of learning materials in a multimedia format, has been developed to ensure that learning materials are thought provoking and reusable replacing the reportedly unacceptable traditional method of teaching in the subjects of science.

The research addresses likelihood and effectiveness of developing learning materials for science education into an adaptive learning system. The research is a systematic approach towards learning facilitation with enhanced enthusiasm, an attempt to establish an agreed method of formal and informal environmental education as well. The investigation analyzes comparison of the students' perceptions towards difficulty levels experienced during the traditional method of education. We have extended multimedia based learning tool as learning objects to teach students with an individual adaptive learning experience. We have evaluated the tool confirming its effectiveness and acceptability for students learning. The innovative approach is found to strengthen effective exchanges between the pupils and teachers providing leadership and practical know-how to the concept of sustainable development. It also corroborates voluntary participation, seldom seen in traditional methods of teaching-learning system. Statistically analyzed data indicates that the innovatively designed multimedia system of instruction is reportedly acceptable, inviting voluntary participation of the pupils, palatable and deepens understanding the concepts to a greater depth, and facilitates distance education and in-service teacher training objectives. The multimedia-learning, a new approach to education has proved to invite voluntary participation.

Keywords: Adaptive learning system, effective communication, learning facilitation.

Introduction

An integrated process for environmental education through multimedia instructional system has not been incorporated yet in the educational scenario yet across the country. Although environmental education has been introduced into many curricula, this is only a beginning step. The incorporation of instructional system is hopefully to play a crucial role in deepening the understanding of the environmental education among the pupils and is required to set ourselves on fruitful sustainable paths. Most instructors want to make the classroom a place where students are encouraged to test ideas, make connections among subjects and content areas, explore problems and issues, work cooperatively, and become lifelong learners. They believe that students must be intellectually engaged and actively involved in their learning, and that traditional instruction is likely failing to provide this engagement. Tremendous efforts have been made by educators to help students learn. Peer group and collaborative learning have been introduced into classrooms. Collaborative learning promotes communication of ideas and understanding of concepts. In view of implementation and investigating the efficacy of the method of collaborative learning "Multimedia instructional system" was developed for environmental education to study its efficacy in the teaching learning process, an innovative education process for sustainable community development and it has been experienced with reinventing the concepts of education and development.

The approach has observed to have broad implications in the education process. The main objective of this study was to examine the practicability of multimedia instructional system for an education process, which is expected to contribute to easing the educational process that in turn contributes to a sustainable community development as exemplified by the research output. The participatory research data has been used to extend theoretical perspectives on applications of multimedia instructional system and environmental education and to reinforce new directions of research on education and sustainable communities. The research focuses on designing instructional systems, its efficacy in processes in learning and instruction, delivery systems and evaluation of instruction in the context of Environmental Education.

Methods of study/design of study

The standard systems view of instructional design is depicted as under:

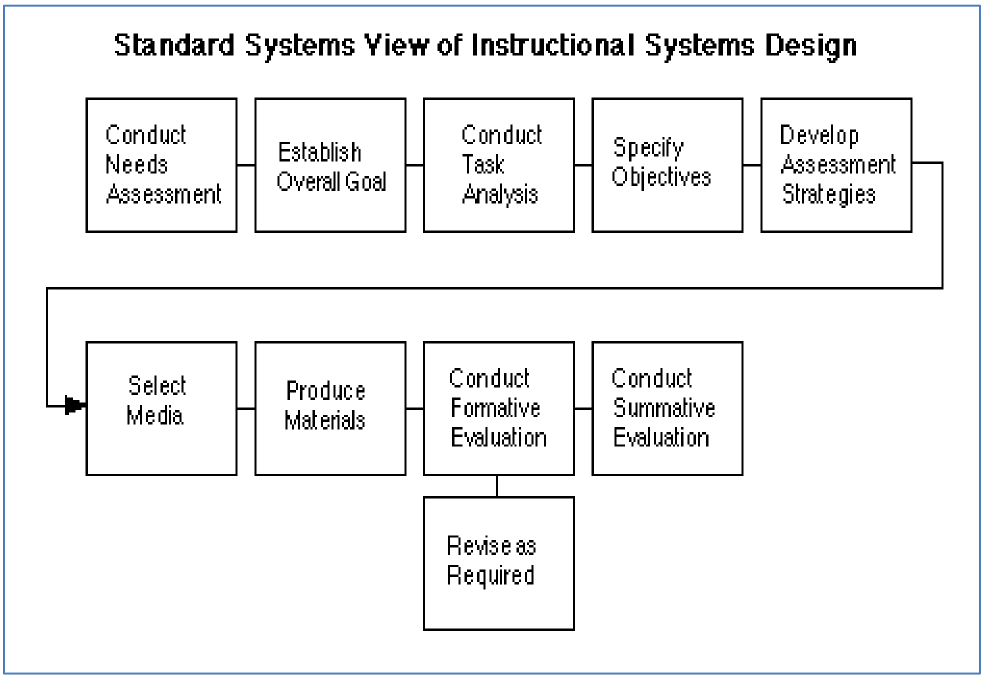
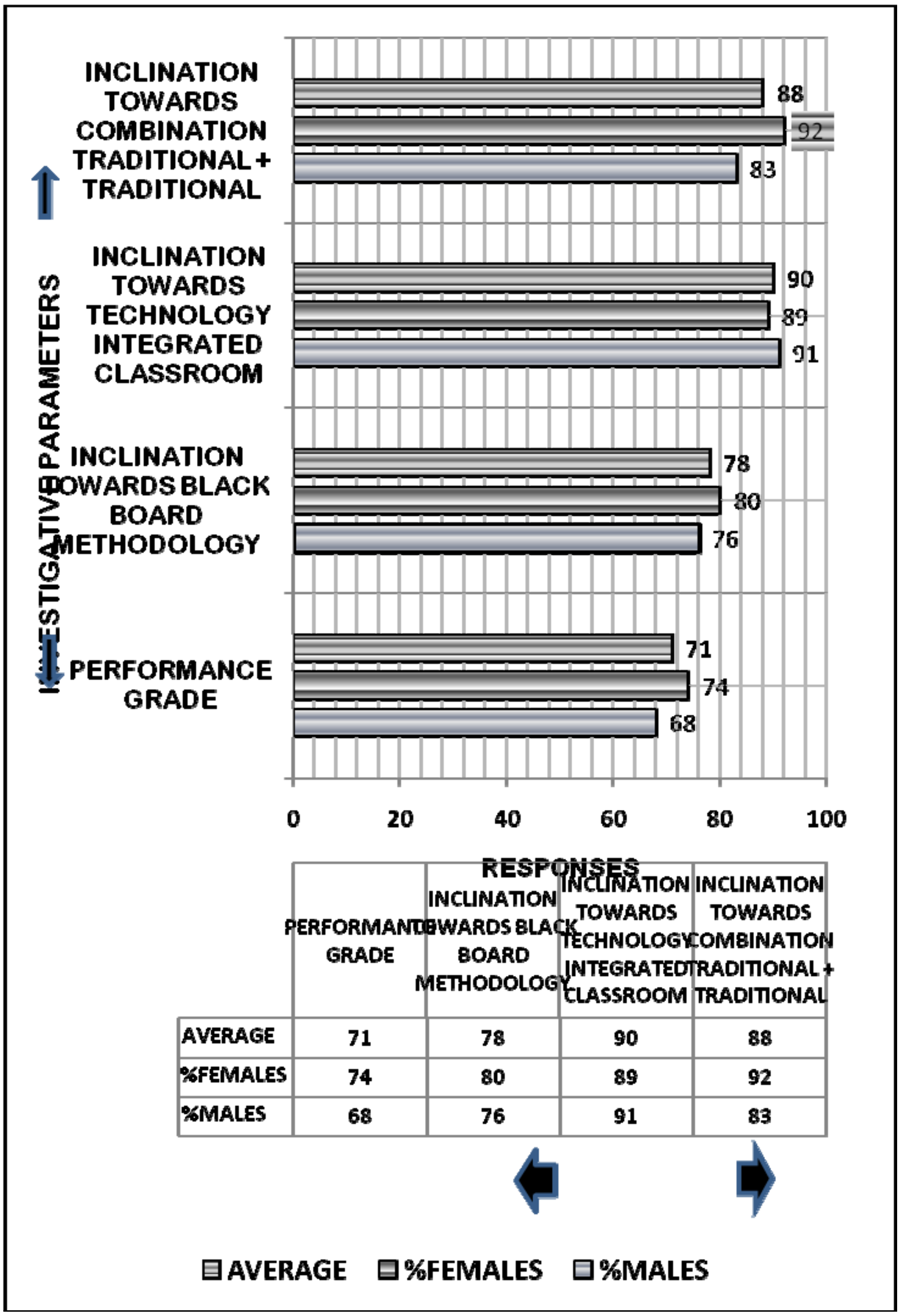


Fig 1. Standard Systems view of instructional Systems Design

Table 1. Gender attitude or performance towards investigative parameters

INVESTIGATIVE PARAMETERS	GENDER ATTITUDE OR PERFORMANCE		AVERAGE
	% MALES	% FEMALES	
➢ Performance Grade	68 (B)	74 (B)	71
➢ Inclination towards traditional Black-Board methodology	76	80	78
➢ Inclination towards Technology integrated classroom environment	91	89	90
➢ Inclination towards combination of Technology integrated classroom environment with traditional methodologies	83	92	88
n Males = 83, n Females = 79			



	PERFORMANCE GRADE	INCLINATION TOWARDS BLACK BOARD METHODOLOGY	INCLINATION TOWARDS TECHNOLOGY INTEGRATED CLASSROOM	INCLINATION TOWARDS COMBINATION TRADITIONAL + TRADITIONAL
AVERAGE	71	78	90	88
%FEMALES	74	80	89	92
%MALES	68	76	91	83

Figure 1; Graphical illustration of Gender attitude or performance towards investigative parameters

The design of the study includes a sequencial flow chart of the system involved as; Conduct needs assessment, establish overall goal, conduct task analysis, specify objectives, develop assessment strategies, select media, produce materials, conduct formative evaluation, conduct summative evaluation, revise as or if required. The design further had an investigatory intention ;-

1. To analyze the conventional approach of teaching Environmental Education.
2. To plan multimedia instructional system for Environmental Education.
3. To design and construct multimedia instructional system for Environmental Education.
4. To test the effectiveness of constructed multimedia instructional system.
5. To compare the effectiveness of constructed multimedia instructional system with the conventional system of instruction.

6. To validate multimedia instructional system in terms of their effectiveness over conventional system of instruction.
7. To equip the pupil teachers and teacher-educators with reliable system to overcome the difficulties in theory course of Environmental Education instruction.

The above investigation was performed under traditional classroom environmental settings that investigated the relationships between student performance in introductory method of curriculum delivery, various educational characteristics, learning preferences, and the potential effectiveness of technology as a medium of instruction to complement face to face teaching. The survey consisted of the student consent form along with the three levels of instrumentation which were developed to collect quantitative and qualitative data for this study. It could be administered quickly in the large introductory class.

Results and Discussions

The investigations resulted in elevating pupils interests in curricular studies a sign of development of a positive attitude towards science is one of the most important goals of the curriculum as also observed by Koballa and Crawley, Laforgia, (1988). Activity-based joyful learning approach as an emerging trend in the field of teaching methodology/strategy, is important for our school education as reported by Panda & Basantia 2004). Lewin and Potter (1947) reported that children get answers to questions by finding out their own routes to discovery.

Investigations proved effective to reduce the dimensionality of the learning items of the learning perception survey to more basic variables based on the responses received from the participants. Based on the nature of the statement items and Bloom's Taxonomy of the cognitive domains, these six factors were named individually as Learning By Rote (Factor I), Learning By Relating (Factor II), Learning by Comprehension (Factor III), Learning Through Formula Derivations (Factor IV), Learning Through Effort (Factor V), and Learning Through Practice (Factor VI). Further, the results of the evaluation of the students' performance were based upon their semester long grades on exams and homework assignments. Overall, 68 percent of male and 74 percent of female participants received a final grade of B or higher (Table 1). No significant performance differences were found between male and female students (Fig. 1). This study found that participants performed better by trying to understand the learning material and relate problems to real world situations. Participants who relied on rote learning did not perform well. It was reported that computer-supported and interactive learning environments better serve the diversity of students. Results from the qualitative method at this study showed that a majority of students were on the whole positively inclined to having the pedagogy with the integration of educational technology, such as PowerPoint presentation, visualization, simulation, and found it helpful in learning. The results were also positive about advantages gained from the use of Black Board and interactive communications such as asynchronous discussion. About 90% of students in the technology-integrated classrooms reported being benefited by the learning environment while 78% of students in the traditional classroom setting indicated their preference in having the technology-integrated curriculum. Further, the student performance in the technology-integrated classrooms indicated that 90 percent of the technology-inclined participants compared to 78 percent of the black board methodology (Table 1).

The student performance technology inclined participants as compared to the traditional lecture-format classroom showed progress and were satisfied with the current technology integrated classroom instruction format. In this study, however, no significant gender difference was found between students who favored the integration of the technology in the introductory design and students who favored to learn under the traditional instructional format.

Investigations endorse a constructive framework for science communication, communicating abstract aspects more efficiently proving the attempt to have the ability to turn information into useful knowledge. It has found to stress skill development nurturing the development of good habits of mind, having applications beyond passing a test. Learning through technology integrated plans and teaching materials need to include a relevant context for new information to lead to broader understandings. During traditional teaching methodology it is often hard for students to understand the connections between activities within a particular subject. This confusion is heightened when students struggle to understand the connections between different subjects within traditional classroom environment and can be overcome with the integration of technology with pedagogy. "Habits of mind" should be an important goal, or outcome, in education. These habits can produce a world view that incorporates different disciplines or subjects. They can be thought of as the "ground rules" for a particular discipline, and include, but are not limited to, verification and respect for data in science. The attempt endorses successful implementation of inquiry learning indicative of active learner involvement leading to important outcomes in the classroom. Observations indicate that participants made active observations, collected, analyzed, and synthesized information, and drew conclusions developing useful problem-solving skills. These skills can be applied to future "need to know" situations that participants shall encounter both in the educational sector and at work. Another benefit that such framework offers is the development of habits of mind that can last a lifetime and guide learning and creative thinking.

Recommendations for future research:

Collaborative learning, real world application, interaction with instructors, and using technology as tools were perceived by students as helping them learn the complex concepts. Based upon the results of this study, several recommendations for further research can be generated. The exploration of the confounding effects related to learning perceptions, integration of technology in aiding the student comprehension, and the performance needs to be done to fully understand the features that enhance students learning best and which instructional formats are more potent than others.

Acknowledgment

We gratefully acknowledge the long term co-operation by the Principal, Mr. G.N. Chitte, Sangameshwar College, Solapur, for availing liberty and extended facility of the library resources for this particular research work. Last but not least I extend my gratitude to the technical laboratory staff of Department of Physics, Sangameshwar College, Solapur, for their vital role during the investigation period.

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Eco-Friendly Management of Phytopathogenic Fungi

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Abstract. In order to maintain the productivity of various crops more and more synthetic chemicals are being added in the natural environment by the farmers and layman who enter the food chain through water, soil and air as a result it seriously affect the human health and environment. According to the World Health Organization survey, more than 50,000 people in developing countries are annually poisoned and 5,000 die as a result of the effects of toxic agents, used in agriculture. In India 35,000 – 40,000 tons of hazardous chemicals are sprayed on the crops every year, instead of helping the poor, these chemicals are causing cancer, sterility and death. These synthetic chemicals are unsustainable and uneconomical in the long run. So there is an urgent need to develop sustainable methods for these horrible diseases. The remedy lies in the use of more natural products which do not damage the ecosystems such as biofertilisers, bioinsectisides and biofungicides. Persistent literature reveals that plants are rich sources of bioactive agents as plants and their product are known to possess various secondary metabolites including alkaloids, coumarimes, flavonoids, steroids/ terpenoids, quinines, tannins, phenolic and resins etc and are responsible for the biological activities of the plant extracts, which showed inhibitory effect against the growth of pathogens. Therefore, the plants and their product should be utilized to combat the diseases causing pathogens. So, it is advantageous to use these plant-extracts to combat the pathogens, instead of using synthetic chemicals as these chemicals are hazardous to human health and deteriorate the environment. Hence eco-friendly management of crop's diseases is the only safe substitute to be explored to control these phyto pathogens and to maintain sustainable agriculture and environment. Keeping these problems in view, efforts are underway to search economic safe phytochemicals, which could be utilized for disease control. Thus in the present study laboratory bioassays were performed to evaluate the antifungal activity of one hundred and twenty plant part extracts of hundred plants spanning over forty five families against three plant pathogenic fungi by the food poisoning method in terms of measuring the percent reduction in mycelium growth as compared to control. The various plants tested for their antifungal activity have shown varied response. The results are promising and some of the plants have shown inhibitory activity against one or two fungi whereas others have shown a broader spectrum of activity, some plants showing good activity against all the test fungi. Plants samples of some families such as *Apocynaceae*, *Caesalpinaceae, Combretaceae*, *Compositae*, *Ebenaceae, Liliaceae, Lythraceae, Meliaceae, Mimosaceae, Rosaceae*, *Salvadoraceae*, *Sapindaceae, Theaceae* and *Zingibraceae* were found to be comparatively more effective against the test fungi.

In view of the above facts, the present study has elaborated our knowledge by accessing the antifungal properties among the available natural flora which can subsequently be explored for the possibilities towards the identification of the key bioactive agents, through implying modern microbiology and biochemical techniques.

Keywords: Plant pathogens, Antifungal, Plant extracts, Phytochemicals

Challenges in Implementing the Electronic Patient Record in The Context of Healthcare Reforms in Uzbekistan

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Abstract. One of the important aims of the reforms in Uzbekistan is to deliver qualitative medical care to all citizens. On the other hand qualitative care should be safe, effective, patient centred, timely, efficient and equitable. Based on the ongoing reforms in the health care sector it was decided to implement the use of the electronic patient record (EPR) as one of tool in improving the quality of health care delivery. At the beginning the EPR is introduced in eight of the medical clinics in the capital city Tashkent as a pilot project. It's clearly that the EPR gives new opportunities including reducing clinical errors, improving patient safety, and allowing clinicians to communicate more quickly and accurately and to identify relevant information more easily. Moreover good EPR systems can increase efficiency, reduce duplication and waste, and improve the cost-effectiveness of health services. EPR systems can also make information much more readily accessible to patients, allowing them to assume more control over their health records and thereby become more active in their own care. In addition, electronic databases of health information can be used for a range of purposes other than direct care provision, for example clinical audit and research. In spite of all benefits the learnt experience showed that the following issues should be considered before implementing the (EPR) widely in the context of Uzbek health care system:

1. Many health care professionals don't know how to use computer and consequently have difficulties in using the electronic patient record.
2. It's necessary to point out that the computerization level is varied widely in different regions in Uzbekistan. That's why there's a need to change the infrastructure as well as significantly upgrading hardware software and network infrastructure where necessary.
3. EPR also brings new risks, particularly to the privacy and safety of health information. Electronic systems allow access to data from many locations, increasing the likelihood of a security breach; they can also give individuals access to much more data than was previously possible, increasing the damage caused by system misuse.

There's no doubt that EPR will be beneficial in the context of the Uzbek health care system. But it requires significant changes in the system particularly the following activities should be undertaken:

1. To educate health professional in modern information technologies as well as introduce into curriculum of medical institutes the elements of EPR system
2. To estimate the computerization level of health care facilities and to consider the patient safety.

Keywords: e-Charts, Developing country

Need of Comprehensive Approach to Trained Science Journalist

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Abstract. The question of how science engages publics is becoming important everywhere in the world. With the spread of mobile and Internet technology, the growing food crisis, the threat of global warming, the expansion of medical research sites, the development of genetically modified crops, and the challenges of particular diseases and health care. As one way of making the widespread implementation of innovations possible, new information technologies are reshaping the nature of knowledge mobilization, hence public engagement with science and the engagement of publics by science, is becoming increasingly important. The dissemination of knowledge demands special skills and keen interest in science and related topics, therefore the role of science journalists, trained and skilled becomes very important. At the journalism schools and news organizations, the development of new "modern science and technology" beat should be encouraged. This will fill in the gap between the technical backgrounders preferred by the science writers and the conflict emphasis of political reporters; it will provide important background for debates on science policy. A trained science journalist can assist in raising awareness of the role of science in society.

Keywords: Public engagement, Dissemination, Trained, Skilled, Modern science technology

Imparting Artificial Insemination Technique and Pregnancy Diagnosis to DCS Staff–A Study

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Abstract. Artificial Insemination (AI) Technique was the first great biotechnology applied to improve reproduction and genetics of farm animals. It has had an enormous impact world wide in many species, particularly in dairy animals. In India to improve the local breeds for milk production, thereby India achieved the number one position in Milk Production in the world (110 MT) Accurate artificial insemination technique requires concentration, attention to detail, a clear understanding of female reproductive anatomy and physiology. This is an art even laymen can perform, provided one should undergo proper training and trainee should work with numerous reproductive organs which are brought from slaughter house, and receive considerable practice inseminating a variety of live cows and buffaloes. This study was conducted at KMF Training Centre, Dharwad. The 30 days duration programme divided into 4 sessions: theory session, hands-on session, practical session and field session. After training it was assessed for conception rate, calf born rate and treatment done by the trainee. Some trainee needs Refresher Training. These trainees are working in the Milk Co.op. Society and doing wonderful job in the dairy battle field of artificial insemination without frontier's. "Everyone who is successful must have dreamt of something."

Keywords: Artificial Insemination, estrus, semen, Liquid nitrogen, Dairy Co-op staff

INTRODUCTION

Artificial Insemination is the deposition of semen (spermatozoa) in the female genitalia by instrument, rather than by male genitalia. The semen is collected from the male genitalia by using artificial vagina method; the same one deposited or diluted form into the female genitalia by using mechanical method (AI gun).

Artificial Insemination (AI), as practiced by bees and many other flying insects, has played an important role in plant reproduction for a very long time, use of AI in animals is a human invention and more recent. Undocumented tales exist of Arabs obtaining semen from mated mares belonging to rival groups and using the same semen to inseminate their own mares. AI had its origin in 1322 by Arabs First AI to domestic animals was conducted in dogs by Italian Physiologist. In 1678 Leenwenhock discovered the sperm and these are capable of making female pregnant. First Time in India in the year 1939 it was done by Dr. Sampath Kumar at palace dairy farm in Mysore.

In the initial stages of attempting to develop AI there were several obstacles. The general public was against research that had nothing to do with sex. Associated with this there was the fear that AI would lead to abnormalities. Finally it was difficult to secure funds, to support research because influential cattle breeders opposed AI, believing that this would destroy their market of using a bull for insemination. Later on fear was overcome with positive facts.

The acceptance of AI technique world wide provided the impetus for developing other technology such as cryopreservation and sexing of sperm, estrus cycle regulation and embryo harvesting, freezing, culture and transfer and cloning. And new, highly effective methods of sire evaluation were developed. The history of development of AI is reviewed, particularly in dairy cattle in which the impact on genetic development and control of venereal diseases has been investigated. In females detection of estrus cycle and control of estrus cycle also were important. The development of AI is a remarkable story of tireless workers dedicated to the pursuit of knowledge, to the replacement of fiction with facts, and the application thereof. In the whole world almost all developed and developing countries are accepted the AI technique. This technology is carried out by dairy farmers in some countries. Whereas in India government hospitals, milk dairy co-operative staff and NGO's are doing.

Objectives

(1) To teach trainee how to place diluted semen in the most appropriate part of the female's genitalia organs to maximize subsequent conception.
(2) Trainee should obtain a working knowledge of female reproductive anatomy and physiology.
(3) Identify the proper estrus state.

(4) Developing the skill to thread the insemination gun through the cervix.
(5) Handling of liquid nitrogen containers.
(6) The important of proper sanitation.
(7) The teaching of detection of pregnancy by use of manual palpation per rectum.

Methodology

A study was conducted at KMF Training Centre at Dharwad in North Karnataka for the last 25 years more than 3000 DCS Staff of heterogeneous mass of men and women were trained in AI & PD. For the purpose of study randomly selected 300 DCS Staff trained. A sample questionnaire was used for Primary data collection such as sex, age, qualification, socio-economical status of the trainee. And further necessary secondary data information collected from the trainee's, farmer's, Extension Officers, Veterinary Officers and other Senior union Officials about the performance of the trainee's.

(a) Sex

Sl.No.	**Sex**	**No.**	**%**
I	Male	2600	86.70
II	Female	400	13.30

(b) Age group

Sl.No.	Age	No.	%
I	20-25	1448	48.20
II	25-30	660	22.00
III	30-31	425	14.10
IV	35-40	327	11.00
V	40-45	140	04.70

(c) Caste group

Sl.No.	**Group**	**No.**	**%**
I	General	1408	46.93
II	OBC	902	30.06
III	SC	298	09.93
IV	ST	142	04.73
V	Others	250	08.35

(d) Educational qualifications

Sl.No.	**Qualifications**	**No.**	**%**
I	Secondary	528	17.62
II	Pre-university	1520	50.66
III	Graduate	682	22.73
IV	Post Graduate	149	04.96
V	Others	121	04.03

(e) Socio-economical status

Sl.No.	**Category**	**No.**	**%**
I	BPL	1525	50.83
II	SMF	1120	37.33
III	MMF	300	10.00
IV	Land Lords	55	1.84

AI training consists of 25 member trainee's in a batch, again batch is divided into 4-5 groups for the purpose practical in each group contains 5 trainee's. On first day of training registration, introduction and orientation about the programme were done.

(1) Hands on session(slaughter house)
(2) Practical session(classroom)
(3) Theory session(classroom)
(4) Field session (Hospital)

Hands on session

Veterinarians along with trainee's visit the slaughter house in the early morning. Before slaughtering the animals are brought to the near by Veterinary Hospital for rectal examination. In each group five trainees one animal is provided, for rectal examination, the trainees should be asked to have finger nails cut, Jeweler removed (female) and wear gloves with sufficient lubricants.

Veterinary doctor along with trainee put their hand together per rectal how to catch hold the cervix and examination of the different parts of the female genitalia such as uterine hams, uterine body, ovaries, matured follicles and corpusluteum while practicing repeated / in expert practice of the produce may result in severe straining, ballooning of the rectum, bleeding or some times thickening of the rectal wall in such condition animal may be replaced, Usually five trainee's are allowed to examine. One animal in the beginning session later on up to eight are allowed to examination. Animals used for hands-on session once session not be reused (same day these animals are slaughter). While palpating reproductive tract to find the anatomical land mark for insemination trainee will usually obtain an idea of the overall size of the reproductive tract. Some trainee's may get the impression that the larger the cervix is the longer the reproductive track, this assumption is not correct. There is not a strong relationship between size of the uterine body and the diameter of the cervix or length of the reproductive tract. This may lead to inseminators/trainee making insemination errors. This hands-on session (slaughter house) is about 10 days. By the end of this session trainee will able to asses the reproductive tract size, different parts of the uterus, callable of catch hold of the cervix without much strain/bleeding and he/she is able to pass the AI gun through cervix because some animals are in estrus stage, some may be infected with venerable diseases. In per rectal examination some animals are found pregnant, trainee will get the idea about the size of the uterine horns and appropriate duration of the pregnancy.

Practical session (class room)

The slaughtered animals uterus are brought to training centre for examination on table these specimen are placed/examined for:

(a) Identification of different genitalia parts.
(b) Passing the AI gun without seeing the specimen.
(c) Dissection of the genitalia to show the interior of the uterus such as cotyledons, ovaries, corpusluteum, follicles developed and developing.
(d) Pregnant uterus–fetus, foetal membranes, flints, umblical cord, etc.

Theory session (class room)

The following subjects taught to trainee in the class room session:

- Trainees should obtain a good knowledge of reproductive anatomy and physiology of female & male organs.
- Developing the skill to thread the insemination gun through the cervix should not be the only objective and also
- The importance of sanitation and thawing methods.
- The perfection of skills to consistency identifies the proper site of semen deposition.
- Handling of container (liquid nitrogen) and its importance.
- AI history, advantages, management Breeding and feeding and disease control measures.
- Role of hormones produced by the different glands and their role in reproduction.
- Pregnancy diagnosis and its importance.
- Veterinary First Aid drugs and its uses.
- End of the session *Pashupalan* A.V. cassette.

Field session (hospital visits)

Each group will be sent to visit different village level Veterinary Hospital daily in charge of the Veterinary Hospital will take care of the supervision work. Daily trainee's will assess for the following aspects:

(1) Identification breed, age, stage of lactation, general body condition of the animal.
(2) Identification of estrus stage and symptoms externally as well as internal.
(3) Thawing of the semen straw and loading of the AI gun.
(4) Sanitation procedure.
(5) Thread the gun through cervix and placing into the uterine body.
(6) Deposition of the diluted semen.
(7) Recording.
(8) Any advice to the farmer/treatment/follow-ups if any.

Pregnancy

Students/ trainees must prior instruction on the anatomy and physiology of the genatelia of female reproductive organs are given with help of slides, videos and also slaughter house, specimens, inserting the lubricated hands per rectal observe the enlargement of the uterine horns either left or right is the most appropriate method of diagnosing the pregnancy in cows and buffaloes in case of heifers it is easy to diagnosis where as it is difficult in 3-4 calved animals.

Observations: In AI technique

Some of the observations are made while practicing the AI technique.

(1) To avoid the possibility of entering the urethwal opening on the floor of vagina, the insemination (AI) gun should be inserted into the Vulva upward at a 30 C to 40 C angle.
(2) To place the cervix into the insemination gun, maintain slight forward pressure on the gun while manipulating the cervix and slightly ahead of the gun.
(3) The anterior portion of the vagina, termed the formixvagina, tends to stretch rather easily when the insemination gun is pushed forward and beyond the cervix. This may give the false impression that the gun is advancing through the cervix, when indeed it is above, below or to either side of the cervix. But unable to feel the tip of the gun in the cervix(gun may be in the vaginal fold)
(4) The semen deposition place in the female genitalia in the uterine body is quite small, accurate gun tip placement is probably the most important skill involved in the whole AI technique.
(5) Once the gun tip is aligned with the internal cervical os, deposit the semen. Semen deposition take about 5 seconds, slow delivery

maximizes the amount of semen delivered straw and minimizes unequal flow of semen into one uterine horn.

(6) During the process of semen deposition, care should take fingers of the palpating hand or not inadvertently, blocking a uterine horn or misdirecting the flow of semen in some manner.

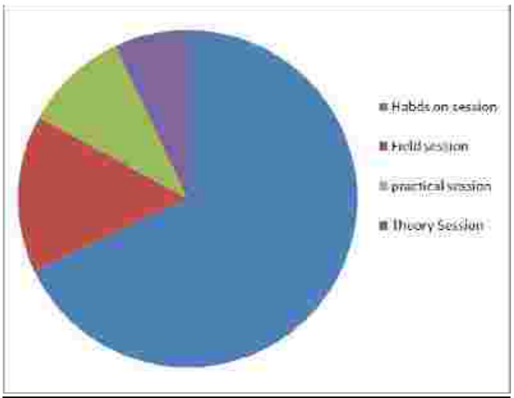
(7) Not to pull the insemination gun back through the service while the semen is being expelled.

(8) If the animal has moved during the semen deposition, if AI gun has moved, stop the semen deposition and correctly reposition the gun tip in to the uterine body and deposit the semen.

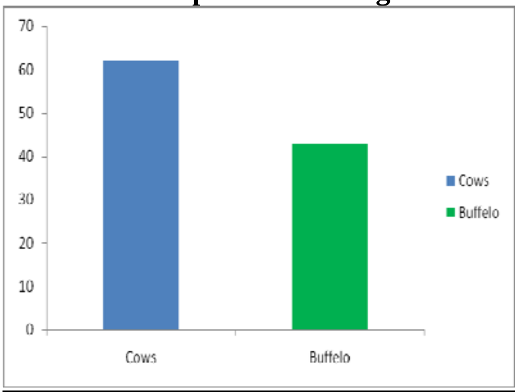
Inseminators generally identify this target area by feeling for the end of the cervix and tip of the gun as the gun emerges through the internal as or opening, depositing the semen in the cervix or randomly in the uterine horns may result in lower conception rates.

Discussion & Analysis

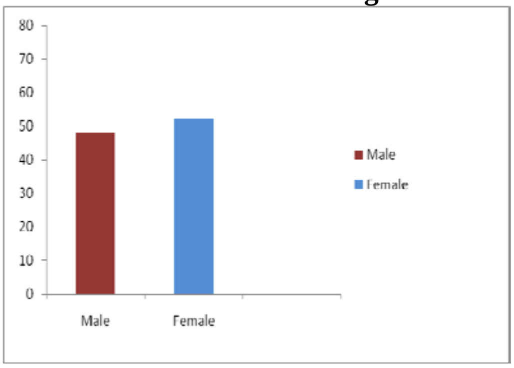
AI and Pregnancy diagnosis technique methods are highly technical and trainee's needs more hard work with memories reproductive tracts and receive considerable practice inseminating a variety of live cows and buffaloes. Developing the skill to pass the AI gun through cervix, handling of LN2 containers, sanitation and managemental aspects are also very important, since the largest group is heterogeneous mass of both sex, they needs different method and technique to understand the technical training. The most of the trainee's expressed their satisfaction 68%. Hands on session and field session are most suitable for the learning complicated technical training. 15% were happy with practical session, 10% were happy with theory session (class room) and 0.7% were happy with audio visual sessions and refresher training.



Conception Percentage



Calf Born Percentage



Conclusion

The knowledge gained from the AI experience was extremely helpful in stepwise developments of each successive, reproductive technology, such as frozen semen, superovulation, embryo transfer and eventually, cloning. And at the same time public become better informed and more willing to accept the technology developed with worthy goals, and built in ethical application, could produce positive change benefiting the whole farming community especially in India. Worthy goals development of the necessary knowledge and skills ethical considerations all are essential components of any technology that will result in a positive impact on society and the environment. Thus, the impact of artificial insemination was much more profound then simply another way to impregnate females.

The study revealed and it is found that, Hands on session and Field Session are most suitable for the imparting AI technique and P.D. to DCS staff as per the study conducted at our training centre.

Recommendations

1. After evaluating records, visit to Dairy Co-operative Societies, farmers interview if it

appears insemination may be a problem. Then, consideration for AI refresher training.

2. All the AI workers should periodically attend a refresher training programme to review their technique, learn new developments and obtain recommendations regarding artificial insemination and pregnancy diagnosis technique.

Acknowledgement

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Study on the Relationship between School Students' Creative Imagination and Family Education Environment in China

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Abstract. Family environment, which was considered as the first individual living conditions and education environment, has strong influence on individual creative thinking. Using creative imagination test and questionnaire, with 116 school students aged from 6-19, this study explored the relationship between students' creative imagination and their family educational environment of Yichun forest area in China.

The findings of this study are:(1) Parents' education Background has influence on students' creative imagination, students whose parents' highest level of education were "elementary graduate illiterate" or "almost illiterate" scored lowest, (2) The creative imagination scores of students whose parents explain their inquiry with great patient are higher, (3) The creative imagination scores of students whose parents encourage them "hands-on" behavior are higher, (4) Communicating scientific knowledge frequently in family is helpful for students' creative imagination.

Summer Scientists Campus: Science as the Basis of Change in the Current Economic Model

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Abstract. The current situation of economic crisis has provoked strong international debate on the validity of the prevailing economic model in western societies in general and more specifically in European ones. This economic model, based on the society of production and globalization, shows signs of serious exhaustion which makes us think that it may need to be modified. Focusing on excellence in education, especially in scientific-technological education, has become a cornerstone of this change towards a more competitive economy based on knowledge, according to what was established in the Lisbon strategy.

According to the data produced by the Eurobarometer in 2005, more than 80% of Europeans believe that young people showing an interest in science and technology is fundamental for the future of their countries. However, it is still surprising that although the number of young people who go to university in most countries has increased over the last few decades, there is an increasingly lower number of students who chose to study scientific-technological courses or carry out scientific studies at stages before University. This trend coexist with a vague and low-valued people's scientific literacy and culture, which are vital to ensure that citizens can understand the challenges and advances which affect modern societies. Besides, if Europe intends to lead the global economy, it needs to train and encourage the presence of high level researchers and engineers.

In Spain, the situation of science and scientific training is not very different to what has been detected in the rest of Europe. In the different studies on Social Perception of Science, carried out by FECYT between 2002 and 2010, the results show that scientific and engineering courses are not attractive enough to young people, even though science and the scientific profession have a good reputation. In other the study carried out in 2010 on young people's perception of science and the scientific profession, the results have shown that teaching sciences in Spanish classrooms does not lead to activities which have been shown to have a high pedagogical value, such as the use of laboratories and carrying out experiments, debates on science and technology or the study of serious environmental and socio-economic problems faced by humanity and their causes.

In view of this situation, the Spanish government, through the Ministry for Education and the Spanish Foundation for Science and Technology, launched the Summer Scientists Campus programme in 2010. The programme was aimed at secondary school students and the main objective was to boost the interest of young people in scientific and technological disciplines through their participation in research projects specially designed for the CAMPUS programme and run by teachers from universities and secondary schools. In this study the results obtained are evaluated and an analysis is performed on the effectiveness of these types of activities to increase the interest of young people in the study of scientific-technological subjects as well as their importance in changing the economic model.

Citizen's Agenda of Science and Innovation: An Innovative Scientific Communication Way Towards Citizen Participation

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Abstract. Citizen participation processes in political decision-making have been taking hold in countries where democratic progress (understood in its true etymological sense as the "people's government") has made it possible to extend the concept of citizenship, moving from what is known as a "formal democracy" to a democracy of a participative nature in which the citizens hold, both individually and collectively, true power.

At the same time, the need to become involved in science as a fundamental component of people's culture is becoming increasingly obvious, as it enables us to comprehend reality, understand the world and have more awareness in decision-making related to our surroundings, at both an individual and collective level. As part of this trend, it is essential to recall the words of Barack Obama in his vote of confidence speech on 29 January 2009: “We will restore science to its rightful place”.

To make this integration of science in culture become a reality, it is firstly important to make citizens understand why and how science is made, promoting scientific communication, from both the public powers and the scientists themselves. This is the only way that society will be able to support and understand the work of scientists and the contributions made by the public powers in relation to scientific and technological subjects.

With the purpose of encouraging citizen participation by integrating the three areas of society involved: the citizens, the scientist and the political decision-maker, the Spanish government launched an innovative and unique project in the first half of 2010, during its Presidency of the European Union: the Citizen's Agenda of Science and Innovation. The initiative was designed as a new route in scientific communication in which citizens, in addition to being able to discover the faces behind great discoveries and innovations could pass on their concerns and priorities in the field of scientific and technological research to the European political decision-makers.

The project presented fourteen European citizens whose creations or research form part of everyone's daily life, even though we are often not aware of the extent to which they have changed our lives. Selected by a committee of experts, the fourteen European personalities came up with and formulated the challenges proposed to the citizens, so that they in turn could value and prioritize which should form part of the Agenda of the ministers of science and innovation. Those proposing the challenges included very well-known people such as the architect Norman Foster, the biologist Jane Goodall and the physicist Juan Ignacio Cirac; and others whose names are less recognised, but whose contributions have undoubtedly changed people's lives, like Franck Biancheri (the creator of Erasmus grants), Karlheinz Branderburg (the inventor of the mp3) and Matti Makkonen (main contributor of SMS)

The citizen participation process was centralised on a website, www.reto2030.eu, for one month and received votes from more than 100,000 citizens. The final result was displayed to the European ministers of science and innovation during the Competitiveness Council which took place in May 2010 using a scoreboard located in the hall of the European Council in Brussels.

Communicating Climate Change Through Interactive Dome Visualization –Frameworks, Potentials and Challenges

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Abstract. Climate change is one of the most fateful questions of our time, largely affecting the general public. The public is thus expected by politicians to take responsibility for actions towards the reduction of climate impact. Since this demands a high level of understanding, both researchers and politicians point out the demand for an uncompromised and scientifically validated public communication on this complex issue. There is an evident need to find ways of communicating the scientific basis of climate change, its global implications and relevant action strategies to a variety of public audiences. Several types of science communication have been developed in different parts of the world to engage the public in climate-related issues and to explain the scientific basis of climate change. A development and evaluation of these types of science communication becomes particularly important when communicating action alternatives and life-style related issues to different audiences.

This paper will focus on an ongoing development project applying state-of-the-art computer graphics and visualization techniques to communicate climate science and policy research. The climate visualization program is presented in a full-dome theatre, with space for 100 visitors, based partly on an interactive geospatial visualization software and partly on 3D animation or video sequences. The program is aimed towards different audiences ranging from students in junior high school to a mixed audience attending the open general program in their spare time.

The objective of this paper is to critically analyze the potentials and challenges of climate communication through interactive dome visualization. Based on our earlier studies and a literature review of studies of public understanding of climate change and climate communication, we have identified two main focus areas, which we consider relevant when designing and implementing a visualization program for dome environments.

The first focus area concerns how we can tailor the visualization program to different target groups. We will discuss the role of narratives and how these need to be adapted to different audiences, as well as how the method of cognitive mapping could be used to investigate the audience's representations of climate change prior to the visit in the dome theatre.

Second, we will develop our ideas of how to engage the public and stimulate climate-friendly lifestyles through the visualization program. Much research has shown that when it comes to environmental issues, there is often a gap between people's attitudes and their behavior, and increased knowledge about climate change may not always lead to a change of lifestyles. Earlier studies have pointed to the importance of placing the abstract issue of climate change in a concrete context which engages audiences on a personal level. Hence, the visualization project will identify narratives that may combine global causes and effects of climate change with local impacts and action strategies. We will also discuss how climate visualization programs could benefit from interaction between scientists and the public during dome presentations.

Decision Modeling in Science Communication

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Abstract. Science communication professionals make decisions based on their experiences, their knowledge of best practices, implicit theoretical knowledge, comments of their peers, creativity and inspiration. Using decision support systems (DSS) aligns all those variables or sources and increases the quality and efficiency of the decisions made on science communication policies and strategies. We developed, and partly tested, in practice two preliminary DSSs: a decision aid for health communication professionals and a DSS to assess the evaluability of science communication projects. These DSSs have structuring and designing properties, but function also as a platform to bridge science communication practice and theory.

One of the main issues in communication in general and science communication in particular is to deal with uncertainties in the science communication process and outcomes. If a science communication professional can assess these uncertainties at forehand, expectations of commissioners and stakeholders could be managed more efficiently. To assess this kind of uncertainty, DSSs we have developed form the very beginning of science communication process simulation. This kind of simulation makes various possible outcomes of the science communication process tangible for science communication professionals. For example, we theoretically designed science communication process simulation for the implementation of smart energy grids in the city of London from a consumer behaviour perspective.

In the paper we will present our first results on DSS and modeling. Our results are a platform, as we see it, for developing a profound bridge between theory and practice of science communication. This bridge finally enhances both science communication practice and theory in real time and in a tangible way.

Formal and Informal Learning on Socioscientific Issues: What Science Education Research Says to the Science Communicator

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Abstract. The boundaries between science education and communication are blurring; learning science takes place in schools as well as in informal environments. What can science communicators learn from science education research when it comes to dealing with socioscientific issues (SSI), e.g. whether or not to have a genetic test in the genomics era?

In Utrecht University a project is running on genomics education and communication for citizenship. This is a project of the Cancer Genomics Centre and the Centre for Society and Genomics, funded by the Netherlands Genomics Initiative and based the Freudenthal Institute for Science and Mathematics Education. The project aims at embedding genomics in science education in terms of curriculum documents and in-service education of teachers. Simultaneously patient organisations and genomics researchers are being empowered for dialoguing on the cancer genomics research agenda and related socioscientific issues. Empowering focuses on conceptual understanding, clarifying the values and moral principles at stake and on raising awareness of different knowledge modes and how these interact.

In the last decade socioscientific issues are getting growing attention from science education researchers, e.g. the role of moral reasoning and discourse in science education. Ethical debate put high demands on teacher competencies and this issue is being addressed as well: how to support decision-making processes and how to balance facts and values.

Currently a review study is being carried out, which will be complemented by an international invitational expert workshop. Both educational researchers and practitioners will be invited to discuss the review study and formulate design criteria, which will be fed into our education and communication (research) activities. Two years ago a similar workshop, entitled 'Rethinking science curricula in the genomics era' was held (see http://bit.ly/bgqtAz). This paper will report the review study and the preliminary results of the invitational workshop with special attention to the implications of science education research on SSI for science communication in informal settings.

Public Engagement on Environment and Government: A Case Study of National Consultations on Bt Brinjal and NMGI in India

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Abstract. Proactive public participation in government programmes at local, state, national and international level is the cornerstone of any successful democratic system today. This assumes even more significance when the communication between the governments and the public on matters related to public health, environment, agriculture, food and nutrition. That public consultation were held, before a decision whether to introduce Bt Brinjal in India or not was taken, is itself shows that the governments in less developed country like India are beginning to understand the importance of public participation in policy making on matters related to science and technology.

The Centre for Environment Education (CEE) conducted national consultations on Bt Brinjal on behalf of Ministry of Environment and Forests (MoEF), Government of India with an objective to consult multiple local stakeholders, belonging to distinct groups, for forward dialogue on Bt Brinjal. Another important objective of these consultations was to compile and collate the discussion held during these consultations in the final report. The final report of February 2010 captured the views of various stakeholders in the process and listed 544 concerns, out of which 93 were in favour, while the majority 451 concerns were against introduction of Bt Brinjal for cultivation in India. The consultation process should have provided a space for discussions and networking across the board for the multiple stakeholders in Bt Brinjal; and should have provided space for discussion among the smaller and lesser voiced debates. It should also have opened a dialogue on the Bt. Brinjal. But after a decision not to allow Bt Brinjal was made by the MoEF favouring the majority concerns raised during consultations.

With nearly 6000 registered participants for the seven consultations, and more than 9000 written submissions, some of them of book length, were presented to MoEF, in very little time for consultations (about 25 hours in total, averaging a little more than 3 hours for each location. From what was collected, MoEF generated a bibliography with over 450 entries. If one of the purpose of these consultations was to get stakeholders' feedback and representations on Bt Brinjal, then an appropriate feedback mechanism could have been established where stakeholders could provide feedback to government on the issue before, on and after the scheduled date(s) for consultations. But, the time available to stakeholders was too short for them to prepare accordingly.

There has almost been no communication between the (public) stakeholders, and the scientific community and the government after the consultations were over and once a decision was taken, though there have been many developments related to the subject. Besides there have been other public consultations.

This paper analyses the process of public consultations on Bt Brinjal and on National Mission for a Green India (NMGI) carried out this year with their objectives and outcomes. There seems to have been little learning in the way such public exercises should be conducted. The total number of participants in consultations on NMGI reduced to less than a quarter than in those for Bt Brinjal, although the general scope of NMGI is much wider and would affect the lives and livelihood of greater number of people than those by Bt Brinjal.

This paper puts forward a few suggestions for the government, scientific community, media, and the stakeholders to make such public consultations on matters related to science and technology in general, and environment in particular, more effective and inclusive so that many individuals, groups, sections and communities not covered by previous consultations could be reached, and there is substantial outcome in the form of mechanisms (permanent or quasi-permanent) and institutions that sustain public engagement with governments.

Social Agency, Justice and Transformation in the Quest For a Globally Representative Communication of Science

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Abstract. The communication methods and educational systems that are applied to report scientific findings and technological advances to the public have come under repeated critical scrutiny during the past few years. This communication process, often overlooks deep seated philosophical and epistemological differences between cultures and continents. One prominent area of neglect is the failure to incorporate the specific knowledge(s) of traditional communities into mainstream epistemological discourse. Traditional knowledge has historically been restricted as 'discoveries' by outsider researchers. The traditional epistemic status of traditional communities, as a direct result, remains to be considered as incompatible with the 'scientific' and 'progressive' nature of modern western knowledge. Modern science and technology, therefore, is deemed to operate above (and beyond) the more 'primitive' processes of traditional scientific methods. Modern science is only prepared to acknowledge the 'primitive' methods of traditional knowledge systems in so far as the latter serves as confirmation of the formers' alleged superior cognitive status. It is from this so-called superior perspective that modernity will allow itself to speak of 'traditional agricultural methods', 'traditional water harvesting methods' or even 'traditional craft production methods'.

In this paper I will argue against this artificial barrier in the communication of science. Considering science principles as universal, and acknowledging the historical role that philosophers play in contextualising science knowledge, I will present some options to guide the re-alignment of global science communication towards becoming a more inclusive activity between the industrialised and developing worlds by asking fundamental philosophical questions about social justice, agency and the possibility of change. My focus will be on Africa and India. I will mention, in specific, the work of western philosophers such as Jürgen Habermas (1981. 1987, 1994) and Richard Rorty (1980) and African Philosophers such as Paulin Hountondji (1997, 2002) and Kwasi Wiredu (1975, 2000). Their opinions will be juxtaposed against ideas that developed in India as explored by Amarthya Sen (2000).

Keywords: western science, traditional science, epistemology and philosophy.

Introduction

In the wake of a near absence in communicating science to the public in Africa, the discipline of African philosophy took as task the topic of science communication to explore the philosophical relation with science in general and with traditional societies in specific. The development of African philosophy, as a result, is closely associated with the advancement of science and technology. This relationship is not unique. It is similar to the development of European philosophy when philosophy-as-epistemology affiliated strongly with the Enlightenment 'idea of progress'.

During the European Enlightenment science became the 'subject' and scientific method was recognised as the measure for progress. This centrality of philosophy-as-epistemology in the 'project of modernity' and its inability to overcome the reliance on a subject-centred epistemological paradigm, is intensely debated by western philosophers such as Jürgen Habermas (1981; 1987; 1994). Habermas initially strived to reconstruct the genealogy of the modern natural and human sciences by inquiring about the details of their social, historical and epistemological conditions of emergence. He later adopted a perspective based on a theory of 'communicative action' derived from speech-act philosophy, socio-linguistics and ideas about conversational implicature (Honderich, 1995:330). Central to the work of Habermas is, however, the effort to combine specialist philosophical interests with an active commitment to promoting informed discussion on issues of urgent public concern (Honderich, 1995:330). Habermas (1981), in this regard, is a promoter of effective science communication.

The modern-day ‘lack of independence’ of philosophy (from science progress) has also been dramatically challenged by western philosophers such as Richard Rorty (1980. 1982). Central to Rorty’s (1980) challenge is the deconstruction of the ontological assumption of (western) man as the privileged seat and centre of human rationality. The notion that epistemology can exist as a discipline capable of justifying and validating scientific knowledge claims, is rejected by Rorty (1980). It follows that philosophy is incapable of providing a neutral universal framework that can be assumed (adopted) to precede, justify and validate the foundational scientific form of knowledge. A significant consequence of Rorty’s rejection of this epistemological foundationalism is his rejection of a correspondence theory of truth, deemed capable of describing reality ‘as it is’. In the place of an objectivist approach to reality as a project of epistemology in the service of science, Rorty (1980:315) encourages his reader to accept the possibility of an *epistemological vacuum* that naturally follows the demise of the modern epistemological tradition.

Rorty’s (1980) arguments against epistemological foundationalism are important in so far as it encourages a re-conceptualization of modernity’s central universalistic claims with regard to truth, objectivity and rationality. For as long as nature (the universe) is assumed to be absolutely (ontologically) of humankind, the scientific enterprise will likewise be conceptualized as a discipline that transcends the more parochial interests and passions of the non-scientific thinker.

The importance of this argument for us is Rorty’s (1991:166) promotion of a ruthless scepticism about philosophy’s self-definition and epistemological ‘task’ in the defining of science. He criticizes the limitations of philosophy-as-epistemology to recognise appropriate scientific (including traditional) knowledge since science in its current form provides humanity with a basic ‘ticking list’ of observations which too often lacks deeper probing and rules out further reflection. Sandra Harding (1997:49) maintains that ‘modern science’ re-inscribes the dichotomy between the dynamic, progressive sciences of the west and the static unchanging traditional knowledge of other cultures. According to Harding (1997) this condition generates the benefits of modern science to be disproportionably distributed to western elites and she claims that: “… whether sciences intended to improve the military, agriculture, manufacturing, health or even the environment, the expanded opportunities that science makes possible have been distributed predominantly to already privileged people of European descent, at the cost to the already poorest, racial and ethnic minorities, women and Third World peoples” (Harding, 1997:55).

According to Rorty (1980), philosophy should abandon efforts to consider reality through some *a priori* conceptual framework (which we ourselves have put into existence). In addition, philosophy should abandon efforts to claim a universal context for the validation claim of scientific knowledge. Such a post-epistemological approach will render the need for a transcendental foundational discipline obsolete. The real work of science must be done by the scientists, and the philosopher must resist the temptation “… to jack up [the achievements of science] a few levels of abstraction, invent a metaphysical or epistemological or semantic vocabulary into which to translate it, and announce that he has grounded it” (Rorty, 1991:168).

In the place of the modern epistemological legacy of foundationalism, Rorty (1980:315) proposes a hermeneutic approach to rationality and truth in the objective world. According to Honderich (1995:353), hermeneutics refer to “… the inherent circularity of all understanding, or the fact that comprehension can only come about through a tacit foreknowledge that alerts us to salient features of the text which would otherwise escape notice”. Bernstein (1983:38) points out that, according to the interpretation of texts, the earlier traditions of hermeneutics distinguished three elements:“… *subtilitas intelligendi* (understanding), *subtilitas explicandi* (interpretation) and *subtilitas applicandi* (application)”. Heidegger (1977) and Gadamer (1975) extended the application of hermeneutics, initially focussed on the interpretation of text, to the interpretation of technology. Gadamer (1975), for example, proposes that the three features of hermeneutics–understanding, interpretation and application–do not happen successively and functions collaboratively. He focuses on the relation between ‘practical knowledge’ and ‘theoretical/technical knowledge’ and considers hermeneutics to be the heir of practical philosophy which, in turn, bring concepts such as ‘scientific method’ (in the sciences) and historico-critical method (in the human sciences) into question (Gadamer, 1975:342).

According to Rorty, hermeneutics relieves us of the need to justify scientific knowledge claims from a universal perspective. He argues furthermore that the hermeneutic principle of justification of our social principles is sufficient ground for our acceptance of the notion of truth in a pragmatic sense. For Rorty the hermeneutic approach therefore cynically presents “… an expression of hope that the cultural space left by the demise of epistemology will not be filled” (Rorty, 1980:315).

Rorty’s (1980) critique of the modern epistemological condition and his philosophical announcement of a post-modern ethos characterized by contingency and pluralism, (in short, an ethos epistemologically devoid of all claims and pretensions to universalism) opens up the possibility and the need to explore other non-western forms of knowledge and rationality. By accepting the ethno-cultural horizons governing one’s place in history as the point of departure, Rorty (1980) therefore encourages a more conversational approach to the question of knowledge “… with the notion of truth being associated with the best idea we currently have to explain what is going on” (Rorty 1980:320).

African philosophy in service of science

With the European enlightenment promoting scientific innovations, the ‘idea of progress’, it was argued, became the measure of modernism in the west. On the other hand, ‘colonialism’ became the African measure and indicator of scientific progress. It can be argued that colonialisation in Africa marginalised traditional scientific knowledge and traditional practices as rapidly as modern industrial and economic development expanded in the west. Underpinning the idea that all men are the same, the awareness grew that cultures differ and live in different geographical worlds requiring different social strategies for survival. For western science, in the quest to study man, ‘race’ soon became the marker for different social practices that constitute different cultures. Race therefore became a science ‘subject’ and racial differences became a cultural ‘marker’. The paradoxical result of celebrating differences, respect for pluralism and acknowledgment of identity politics – which became the feature of a liberal-modern democratic outlook – made science a political issue since the science of human differences could only be read in a racial fashion (Malik, 2008).This can be referred to as the ‘guilt of science’.

Opinions about the intensity of this marginalisation process vary. Kwasi Wiredu (2000:175), for example, does not consider modernism to be “… bad in and of itself, but [consists of] ill-conceived programs of implementing modernization [that] have been harmful to African societies”. Wiredu (1975:320), in addition, implores us to distinguish, in the African context, between traditional – that is pre-scientific spiritualistic thought – and modern scientific theory.

If we consider that epistemology functions in the total context of the human ‘right to life’ in traditional societies, we need to recognise the universality of these actions. Wiredu (1975), in a sense, blames the west for looking at traditional African epistemology in a highly selectively manner, thereby overlooking the very specific, non-scientific characteristics that typify African traditional thought in general. The west tends to define this specific non-scientific characteristic as a way of thought to be peculiarly African, instead of looking at it in a broader context and acknowledging its striking similarities to western epistemology.

Kwame Gyekye (1997) is less critical about the west’s duplicity in the even distribution of modern science and advocates acceptance of western modernity by Africa. According to Gyekye (1997:30), ‘modernity’ is to be considered an ideal measure of progress. ‘Traditional’ should be seen as something that should aspire to this ideal of progress by embracing the theoretical development of science that requires sustained scientific probing since “… the impulse for sustained scientific or intellectual probing does not appear to have been nurtured and promoted by our traditional cultures”. The African philosopher Kwame Appiah (1992), in contribution to this debate, initiated intense and widespread discussions in Africa on the relationship between race and culture and the differences between indigenous and global knowledge systems. He became overtly concerned with efforts to define the course and causes of development in relation to the growth of science.

Emmanuel Eze (1997:12), who persuasively postulated that the philosophical notion of ‘reason’ was popularised at the beginning of modern (western) philosophy by

Descartes, furthers the argument around indigenous and global knowledge systems by claiming that "… the nature of human rationality seems to require that the best way to define reason philosophically is by demonstration. The demonstration will require amassing empirical or scientific evidence for the rational, and reflecting on this concept of evidentiality". Eze (1997) considers duplicity to be at the heart of modernity whereby modernity, in its subscription to ideals of humanity and democracy, condones the colonial subjugation and marginalization of non-western people by indicating the perceived difference between the rhetoric of the west and the 'lived reality' in Africa.

Based on the contributions by African philosophers, the relationship between philosophy and the sciences is quite pronounced in Africa. Paulin Hountondji (1976:99) in this regard proposes the hypothesis that "… the first precondition for a history of philosophy, the first precondition for philosophy as history, is therefore the existence of a scientific practice, the existence of science as organised material practice reflected in discourse. But one must go back even further: the chief requirement of science itself is writing. It is difficult to imagine a scientific civilisation that is not a civilization based on writing, difficult to imagine a scientific tradition in society in which knowledge can be transmitted orally. Therefore African civilizations could not give birth to any *science*, in the strictest sense of the word, until they had undergone the profound transformation through which we see them going today, that transformation which is gradually changing them, from within, into literate civilizations".

Ivan Karp (2000:4) appropriately observes that it is clear that African philosophers are divided into two camps; those who believe that technical and academic philosophy provides the tools for a much needed critique and revision of traditional African thought and those who argue that the critical skills and attitudes of western philosophers can also be found in African cultures. However, both these positions have roots in academic and social movements originating from the west. What is lacking is the centralisation of this debate within a non-western context.

Moving Towards Individual Agency, Abstract Theory and Openness–Examples From India

African philosophers realised that they are not alone in feeling marginalized from mainstream science and from being considered within the proviso of being 'underdeveloped' and 'unscientific'. Parallel problems are identified by, for example, the Subaltern group in India whose members argue that the specificity of the subaltern voice (by implication their epistemological contribution) has been systematically erased by both colonial and nationalist historians. The term 'subaltern' is used to group together the section of society who faces oppression (Morton, 2003). The Italian Marxist, Antonio Gramsci (1881–1937), used 'subaltern' to refer to a person or group of inferior rank or status caused by race, class, gender, sexual orientation, ethnicity or religion. He considered subaltern groups to be, by definition, subjected to the authority of ruling groups even when they rose up in rebellion. His definition of the subaltern was adopted by Gayatri Spivak (1998; 1988) and others because it easily provides a key theoretical resource for understanding the condition of the poor, the lower class and peasantry in India. The parallels drawn by Gramsci between the division of labour in Mussolini's Italy and the colonial division of labour in India, made this possible.

In both India and Africa there is a drive for recognition and respect for the complexities of the motives and cultures of these subaltern agents. This includes, as Karp (2000:3) suggests, respect for "… the complicit role of the intellectual in the power politics and crises of the postcolonial state; the role of criticism in the politics of knowledge; and the conflicts among cosmopolitan, nationalist and indigenous forms of knowledge. Intellectual historians and sociologists of knowledge will have to work out the reasons why parallel critiques have developed in such different disciplinary locations and discursive spaces in Africa and India, and they will also have to work out the differences as well as similarities in the ways in which postcolonial criticism emerges as a formation in two such different geographical and cultural locations".

In India, Amartya Sen (2000) aptly considered these issues mentioned above and, in addition, emphasised the role women can play in bringing about social change through agency and as free agents of change. Sen (2000) discussed in some detail the approach to gender differentiation from studies conducted by Jean Drèze and Mamta Murthi in India in 1999. When considering the high rate of female and child mortality in male dominant societies, causal relations to development were probed in variables, positioning low survival prospects against areas of possible agency: female literacy rates, female labour force participation, incidence of poverty, levels of income, extent of urbanisation, availability of medical facilities and the proportion of socially underprivileged groups (caste) (Sen, 2000).

Two aspects regarding the promotion of literacy in India became clear in the surveys conducted by Drèze and Murthi (1999). In the first place gainful employment produced ambiguous outcomes: responsibilities for household work became an added burden. In the second place, becoming more literate statistically showed a significant reduction of under-five mortality. Finally "… the impact of greater empowerment and agency role of women is not reduced in effectiveness by problems arising from inflexible male participation in child care and household work' (Sen, 2000:197).

Dual Worlds, Multiple Problems–Solutions Through Agency

By looking at hermeneutics, as proposed by Rorty (1980), we are provided with an option to experience some measure of relief from a need to justify scientific knowledge claims from a universal perspective. When we apply the Rortian hermeneutic principle as aid in the justification of our social principles, we might find sufficient ground for change. What these changes should aim to be, however, is difficult to establish. If we liberate the debate from the social movement of post-colonialism we create a 'freezone' where new perspectives on developmental issues can become intertwined with debates on 'scientific validity' and 'scientific literacy' – both prominent issues in science communication debates and the research focussed on by the Public Understanding of Science (PUS). This, however, is no easy task and comes with its own particular and spectacular problems. Aijaz Ahmad (1992:315), for instance, persuasively speculates about a world devoid of differentiated structures and the disappearance of the so-called 'three worlds'. In the problematic issue of merging the world economies, he mentions the subordinated partnership of developing countries with imperial capital as a debilitating factor. He proposes that "… most of the Asian zones simply cannot ever hope to develop stable societies, and the devastating combination of the most modern technology and backward capitalist development is likely to inflict upon these societies, on lands and peoples alike, kinds of degrees of destruction unimaginable even during the colonial period".

The most appropriate option I can think of is to turn–yet again–to the philosophers for redemption. How will they advise science communicators to effectively promote science communication against such a diverse and complex background? Three scenarios are possible:

1. *The redemption of traditional knowledge systems (IKS)*. It is now acknowledged that some aspects of African thought are collective and unchanging. To emancipate IKS both Wiredu (1980) and Hountondji (1983) valorise the individual as the agent of change through social and cultural criticism. Both use the colonial and postcolonial as spatial and temporal realities and both require the application of individual agency, abstract theory and openness. More specifically, Wiredu (1980) proposes analytical practice in the quest to solve failed past methods and solutions. Hountondji (1983) proposes the Althusserian neo-Marxist notions with its specifying evolving relationships among power, ideology and a constantly changing social world (Karp, 2000:8).
2. *Emancipatory social justice through agency*. Agency refers to a person being the 'subject of action', who posses the capacity to choose between options and then, ultimately, to be able to do what one chooses. Agency is treated as a causal power (Honderich, 1995:18). In patriarchal societies such as Africa and India, social justice involves more than 'being free to choose'. Social justice means active participation in education. In this regard Marion Young (1990:173) states that: "… a goal of social justice, I will assume, is social equality. Equality refers not primarily to the distribution of social goods, though distributions are certainly entailed by social equality. It refers primarily to the full participation and inclusion of everyone in society's major institutions, and the socially supported substantive opportunity for all to develop and exercise their capacities and realise their choices". Chandra Mohanty (2003:205) adds to this by stating: "Pedagogy needs to be revolutionary to combat business as usual in educational institutions … revolutionary pedagogy needs to lead to a consciousness of injustice".
3. *Critically analyse aspects of modernity and tradition in order to promote individual and social agency in the developing worlds.* Challenging the concept of western modernism is

inevitably linked with the embracement of western capitalism and western scientific rationality. Africa embraced western capitalism but scientific rationality became an ambivalent site of dispute through the polarisation of tradition and modernity. One of the prominent philosophers who challenge Africa to become independent (and literate) in order to participate in the global science debate is Hountondji (2002) who critically recalls comments on the history of integration and subordination of African traditional knowledge to the world system of knowledge. Hountondji, (2002: 501) identifies a number of what he calls 'scientific extroversions' (Africa being forced to integrate into the world market of concepts) which indicates that "… a need to secure an audience or readership, a legitimate need, often leads Southern scholars to a type of mental extroversion. They are pre-orientated in choosing their research topics and methods by the expectations of their potential public which then causes them to lock themselves up into an empirical description of the most peculiar features of their societies, without any consistent effort to interpret, elaborate on, or theorize about these features. In so doing, they implicitly agree to act as informants, though learned informants, for western science and scientists" (Hountondji, 2002: 503).

Conclusion

The list of actions that are required towards achieving social justice in the developing worlds is much more comprehensive and much more complex than the few points I was able to highlight during this presentation. I also hope to further the debate on the complex issues related to the main objective of this conference from a developing world context. As indicated by the organisers of this conference, the economic and social wellbeing of society promotes participatory democracy and implies the ability to respond to technical issues and problems that pervade our daily lives. This, by implication, requires a serious deliberation about the status and relation between modernity and tradition. The perceived gap between modernity and tradition, in facilitation of a better science communication, can only be addressed by a thorough understanding of social justice, the promotion of agency on all levels and collectively amongst all members of society, creating a deliberate possibility of change.

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A Comparative Study on Coverage of Climate Change in National and Regional Newspapers

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Abstract. Climate change is the most important global environmental issue facing humanityin recent times. For developing countries like India the concern with climate change is extremely serious. The impact of climate change can be arrested and mitigated effectively on educating the people and increasing public awareness. Improved understanding of public perceptions about Global Warming can contribute to inform scientific and policy discussions of climate change. Newspapers play very significant role in educating, persuading and even in decision making of people on climate change. The scientific information on climate change provides logical thinking and makes people known about climate change and its dangerous impact on the earth. The reasoning ability thus developed can enable them with greater say in judicious use of resources, energy, reduction of GHGs emission etc. The present study was conducted to compare and analyze the coverage of climate change in national and regional news papers during the COP-15 held in last year and found that adequate information was disseminated. The study aims to bring out role of national and regional news papers in achieving the above stated objectives.

Keywords: Climate change news, Feature, Editorial, Dissemination of information, Educating people

Science Communication Professional Profiles as a Starting Point to Develop Science Communication Curricula

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Abstract. In the last decade the number of science communication training programs has increased worldwide. There are many differences between the programs, as was concluded in the PCST 2008 workshop on science communication curricula and in our analysis of 20 university programs. This analysis (based on information on the internet and interviews) showed that the focus of many of the programs is not very clear, nor is the way the particular programs relate to the students' future professions.

An overview of science communication professional profiles would clarify the various tasks of the professionals and be a starting point to develop educational programs. As far as we know such an overview of professional profiles is lacking. One of the aims of our research at Delft University of Technology is to design a model of science communication professional profiles that may be used worldwide as a basis to draw up science communication curricula and to stress the distinctive features of the programs. The model can be the starting point to formulate competence profiles aimed at recruitment and selection of SC professionals and to create routes for professional development (refresher courses / post-graduate courses).

The model we designed (version 1.0) has been derived from a model for the communication domain that was recently developed by educational experts and experts from the communication practice, commissioned by the Dutch Association of Communication professionals *Logeion*. This model consists of six key tasks / activities communication professionals perform: to analyze, to advise, to create, to organize, to guide and to manage communication processes. Each of these activities is described on six levels. The responsibilities and complexity of the described activities increase from one level to the next. For each of the 36 cells in the matrix it was made explicit 1) which actions a communication professional performs, 2) what could be the output of the act, 3) what a professional has to know in order to perform the task and 4) what kind of skills (s)he needs to have. For each professional a profile can be created: a combination of activities on the same or on different levels.

Based on a workshop with science communication professionals, a survey of professionals and a workshop with science communication educators in The Netherlands we came up with a first version of the model developed for the *Science* communication domain. During the PCST 2010 conference we will present and explain the model and discuss its content and feasibility. We will focus on the profiles and the way they can be used to develop science communication curricula.

A Research on the Methodology of Contents Planning for Science Exhibition as a Way of Science Communication

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Abstract. Science exhibition is one of ways of science communication. Therefore, basic function of science exhibition is to transmit science communication well. Science communication paradigm has moved on from one-way communication called deficit model to two-way communication based on contextual model, and this paradigm shift changed a lot of things, like objectives, public engagement, and messages of science communication. But some science exhibitions in Korea don't recognize this paradigm shift, especially paradigm shift of contents. So, this study focused on this contents paradigm which was expanded from fact-transmission to meaning-transmission, and proposed the methodology of science contents planning in order to transmit the two-way science communication.

To suggest this methodology, literature survey and exhibition analysis was carried out. Through analyzing the expanded objectives of science communication, 7 criteria of methodology were set up: awareness(A), enjoyment(E), interest(I), opinion(O), theory-understanding(TU), process-understanding(PU), social impacts-understanding(SU). And by using the storyline process, the method to extract the message from exhibition analysis was developed. With 7 criteria and the message-extraction method were used to analyze exhibitions in 3 science museums.

As a result, various meaning factors of the message according to the objectives of science communication were found. And through these results, the methodology of contents planning for the expanded objectives of science communication was suggested.

This methodology will be used for curators as an idea bank and the manual of science exhibition contents planning and provide the logical framework in science exhibition planning based on science communication. And it will be used as a basic material for future science exhibition planning.

The Impact of Training on Scientists' View of, and Skills in Science Communication

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Abstract. For most adults in the developed world the media is the primary source of information about science. However, there is a general unrest regarding the quantity and quality of science coverage in the media. Possible sources of this discontent are the media, the public and the scientists themselves. Public knowledge and attitudes have been widely assessed, and many studies have examined media coverage of science. However, few studies have systematically examined the capabilities and other aspects of scientists' ability to communicate. Nonetheless, many organizations and institutions have created training opportunities to help scientists become better at public communication.

The claims for the efficiency of such training programs are often based on anecdotes and basic self-report evaluations. This situation does not allow comparison between interventions, nor evidence-based policy regarding media training for scientists. This study sets out to examine the learning outcomes of science communication training programs and courses. Learning outcomes may include skills, confidence, willingness to take part, attitude towards interacting and public engagement, and knowledge of science-media context (dependent variables). Some of the independent variables involved in scientists' views and skills are assumed to be training, age, gender, field of science, years since final degree, previous experience with outreach, position, and type of institution/employer.

The development of a measurement tool for scientists' views of, and actual skills in science communication was guided by existing literature, extensive interviews with active scientists in order to establish face validity, as well as establishment of test/retest reliability. The instrument, which is intended to serve at a wide range of training workshops and courses, includes three sections:

(1) Professional background, experience with public engagement, and specifically with the media.

(2) Written skills, which are assessed based on three short essays: describing one's research, responding to a question about science in everyday life (e.g. "Why doesn't the doctor prescribe antibiotics for flu?"), and to a question about science's role in society (e.g. "Are humans responsible for the Earth getting warmer or not?"). Responders are also presented with a list of science concepts and are asked to mark those that should be defined when writing to a non-technical audience.

(3) Views section, which includes self confidence in speaking with the media, attitudes towards the science in the media (e.g. importance, level of coverage), the responsibility of the individual scientists, benefits and impediments to speaking to the media, attitudes towards public engagement with science policy, and finally, knowledge about the media and public understanding of science.

Preliminary findings from a "Science writing for the media" course will be presented at the talk. Later on, this measurement tool will enable the assessment of learning outcomes from media training to scientists, which will allow highlighting effective initiatives. It will also be used to compare groups of scientists from different countries or disciplines. Finally, it will allow an exploration of the interactions among the independent and dependent variables.

Update on Communicating Science to the Public through the Performing Arts

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Abstract. Update on Communicating Science to the Public through the Performing Arts Brian Schwartz The Graduate Center and Brooklyn College of the City University of New York bschwartz@gc.cuny.edu In this paper, we report on a very recent international conference at the Graduate Center of the City University of New York. The conference, held on October 29 and 30, 2010 was focused on the Communication of Science to the Public through the Performing Arts. See http://www.sciartconference2010.com/ The conference is based on over 10 years of experience in communicating science to the public through the arts at the Graduate Center under the program Science & the Arts. Each year for the past 10 years, approximately 10 Science & the Arts events were presented. Some programs were one-time events while others, such as the ones related to the play Copenhagen; the celebration of the International Year of Physics in 2005; and the programs associated with the performance of the opera Doctor Atomic by the Metropolitan Opera, were a curated series of performances, presentations and seminars. The conference has invited sessions on the following themes: (1) Science and Theatre; (2) Science and Dance; (3) Science and Music; (4) Science and Films, TV and Radio and (5) Science Festivals and Science Cafes.

The speakers and moderators at the conference include: Frank Burnet, Science Festivals: Cheltenham Science Festival and Other European Festival, http://frankburnet.com/about; Liliane Campos, Theatre: Literary Analysis of Science Plays, http://www.texte-et-critique-du-texte.paris-sorbonne.fr/annuaire/liliane_campos.htm; Jerry Carlson, Film: Film Criticism, http://cuny.tv/series/citycine/carlson.lasso; Marvin Carlson, Theatre: Literary Criticism, http://web.gc.cuny.edu/theatre/faculty/index.html ; Marco Cavaglià, Science Exhibits: Laser Interferometer Gravitational-wave Observatory (LIGO), http://www.aps.org/units/fed/newsletters/spring2010/cavaglia.cfm and http://www.ligo.caltech.edu/; Robert Clyman, Theatre: Science and Theatre from the Viewpoint of the Playwright, http://www.doollee.com/PlaywrightsC/clyman-robert.html; Dorian Devins, Science Cafes and Outreach: The Secret Science Club http://secretscienceclub.blogspot.com/ and http://www.mnn.com/green-tech/research-innovations/stories/the-secret-science-club; John Durant, Science Festivals: Science Festivals in the US and Support by NSF Informal Science Program http://web.mit.edu/sts/people/durant.html; Stuart Firestein, Theatre: Scientist and Critic http://www.sciencemag.org/cgi/content/full/327/5962/146-a and http://www.columbia.edu/cu/biology/faculty-data/stuart-firestein/faculty.html; Alexis Gambis, Film: Imagine Science Film Festival, http://www.imaginesciencefilms.com/about/; Graeme Gillis, Theatre: Ensemble Studio Theatre / Alfred P. Sloan Foundation Science & Technology Project, http://ensemblestudiotheatre.org/programs/estsloan-project/; Arthur Giron, Theatre: Science and Theatre from the Viewpoint of the Playwright http://www.doollee.com/PlaywrightsG/giron-arthur.html; Ira Hauptman; Theatre: Science and Theatre from the Viewpoint of the Playwright, http://www.playscripts.com/author.php3?authorid=408 and http://www.doollee.com/PlaywrightsH/hauptman-ira.html; Roald Hoffmann; Science Cafes: Ten Years at the Cornelia Street Café, http://www.roaldhoffmann.com; Brian W. Holmes. Music: Understanding Musical Instruments: Composing "Updike's Science" http://www.thorpemusic.com/holmes02.html and http://www.classical-composers.org/comp/holmes_brian; Ken Laws: Dance: The Physics of Dance, http://physics.dickinson.edu:16080/~pod_web/; Jodi Lomask, Dance: Capacitor Dance Company, http://www.capacitor.org; Cassandra Medley, Theatre: Science and Theatre from the Viewpoint of the Playwright, http://www.doollee.com/PlaywrightsM/medley-cassandra.html; Ann G. Merchant, Film and TV: The Role of Science & Entertainment Exchange http://www.scienceandentertainmentexchange.org; Odd tOdd, Animation: Science Communication via Science Toons, http://www.oddtoddstudios.com; Sidney Perkowitz Film: Author: Hollywood Science: Movies, Science and the End of the World, http://www.sidneyperkowitz.net; Nancy Rhodes,

Music: A New Science Opera: The Theory of Everything, http://www.encompassopera.org; David P. Saltzberg; TV: Physics and the Making of "The Big Bang" TV Comedy Series, http://personnel.physics.ucla.edu/directory/faculty/index.php?f_name=saltzberg and http://www.symmetrymagazine.org/cms/?pid=1000595; Elizabeth Streb, Dance: STREB Lab for Action Mechanic (SLAM), http://www.streb.org/; Thomas Warfield, Dance: Science the Universal Language of Movement, http://www.ntid.rit.edu/media/full_text.php?article_id=849; Benjamin Wolff, Music: Galileo's Muse, http://galileosmuse.com/; Eva-Sabine Zehelein, Theatre: Literary Analysis of Science Plays, http://www.uni-frankfurt.de/fb/fb10/ieas/abteilungen/amerikanistik/lehrende/zehelein/index.html; Samuel Zygmuntowicz, Music: The Making and Science of String Instruments http://artistled.com/Biographies/Samuel_Zygmuntowicz.htm

Keywords: Science and the Performing Arts, Theatre, Dance, Music, Film and Festivals

Accountability in Science Outreach: Aligning Impact Evaluation with Objectives in Science Outreach to Schools

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Abstract. It is impossible to maximize effectiveness if effectiveness is not firstly defined and secondly measured. Science, technology, engineering and mathematics (STEM) outreach programs have long basked in a reputation of assumed positive impact; programs are often touted with producing many benefits such as improving attitudes towards STEM fields, raising awareness and engagement in STEM careers, increasing enrolments in STEM subjects and generally reengaging students with STEM. However, much of the evidence of these impacts is anecdotal. Increasingly program providers are being asked to empirically demonstrate their program's effectiveness and impact, that is, they are being held accountable.

Empirically evaluating the impact of these programs is challenging. The issue of impact is multifaceted and it is difficult to account for all of the relevant variables. It is hard to obtain large sample and control groups and also to avoid self-selection of participants. Even knowing what impacts or outcomes to look for can be problematic.

With these challenges in mind, a research project was undertaken to map STEM school-based outreach programs across Australia in terms of their aims, reach, model and evaluation, while also conducting case study evaluations into the impact of two outreach programs. The research used a mixed methods design and included participants (*n*1,335) across questionnaires, focus groups, interviews and field observations.

This research highlighted a concerning misalignment between the stated objectives of many outreach programs and their evaluative measures of success. The most commonly cited program objectives were to 'inspire' or 'engage' students and to 'encourage the pursuit of science careers or studies'. However, the evaluation approach of many programs was limited to attendance numbers and informal feedback. Most of the programs detailed in the research cited obsequious objectives statements about intangible outcomes. None reported measurable program objectives that adequately outlined target audiences, intended outcomes or set parameters on these outcomes such as the direction of change, the extent or the timeframe.

There is a need for encouraging STEM outreach programs to adopt objectives-driven, evidence based decision making in program management. This managerial approach, if encouraged across the field, could improve program efficiency and effectiveness as well as provide programs, sponsors and participants with a greater level of program accountability for the resources utilised.

One approach to facilitate evaluation across a program management cycle is the development of an evaluation toolkit for common use among STEM outreach providers with the potential to be tailored to individual program needs. Taut & Alkin (2003) asked outreach program staff to identify the biggest logistical barriers to program evaluation; the most commonly cited barriers were a lack of time, budget and the expertise required to access the data. A common evaluation toolkit would not only drastically reduce the evaluation resource requirements of individual providers, it would encourage a more consistent evaluative measure across the field of STEM outreach. This in turn would allow meta-analyses into the impact of the globally expanding field of STEM outreach. It would also hold great marketing potential for individual providers specifically and the field of STEM outreach generally.

Looking into Theoretical Development of Science Popularization Studies in China

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Abstract. Science popularization, or science communication, holds its ground as a favorable cultural device long since the coming out of new China, but it was not until 1980's that science popularization studies in China stepped into the stage of theoretical integration. This paper is intended to (1) briefly review the scenarios of science communication for the public in a span of 60 years in different cultural contexts, (2) trace down the developing path of science popularization studies at theoretical level by discussing deeply into the focusing issues occurring in the period of theoretical integration.

Since 1980's, the arena of science popularization was boiling with all kinds of arguments. The paper will look deep into the diversified pallet of theories and sayings in the field by concentrating on the most important ones. The main issues were divided into 3 themes: (1) theories of "science popularization" as a discipline, (2) reflections on "traditional science popularization" ideas and their transition and modification, (3) studies on "public scientific literacy".

After the National Science Convention in 1978, while studies on science writing kept receiving attention of some researchers, the attempt to build some kind of theoretical frame for science popularization studies came out and several experiments has been made. This is the first try to make understandings and cognitions of science popularization into a systematical structure based on which a special discipline was supposed to be created.

1990's saw the turning point of science popularization studies under the influences of the Western theories. "Science Communication" studies started from the approaches of communication science and PUS theories. Experts and researchers from universities began to question and criticize the traditional science popularization modes and ideas by pointing out that old notion of "science popularization" can no longer adapt to the new changes science communication requested. They thought science popularization had 3 stages: traditional stage, PUS stage, reflective science communication stage and put forward corresponding communication models and stands to the 3 stages. Their arguments brought transition and modification of old science popularization ideas.

From 21th century, research on "public scientific literacy" became the core subject of science popularization studies. The achievements of such researches were applied in the Surveys of Public Scientific Literacy and the formulation of the *Outline of the National Scheme for Scientific Literacy*. At the end of the paper, the characteristics of science popularization studies in China were summarized.

A Novel Web Based Effort for Sharing of Scientific Ideas and Results

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Abstract. This paper report the study of a web based online portal (www.thinkbiosoln.com) that provides green solutions to cater to small and middle level companies and promote solution based research towards promoting science. The website targets to harness the power of online portal to connect to prospective researchers, and promote them suitably towards developing products.

A complete study on promotion of said technology and there output in number of feasible solutions is shown in this paper. It is a novel model for future ventures to invest in science communication with a goal of resource building and promoting innovation and research.

Keywords: Innovation portal, Science Promotion, Entrepreneurship.

Background

Computer connected through internet and intranet as a platform for communication was presented and modelled much before the actual practice by Licklider *et.al* in 1968. [1]Though early developers in communication were positive about the possibilities, they feared that an online communication of ideas will be restricted due to lack of externalized modelling of the user's emotion and may hinder successful or competent transfer of relevant emotions which justifies the data. Other potential threat to such possibilities includes slow internet connections, interactive web spaces, and lack of high end graphics. [2-3]
Also the potentiality for scientific communications was shown by Robert Kraut to be majorly dependent on the distance between the scientific departments and the subject area of expertise. [4] The clauses for observation were elaborated as communication frequency, quality of communications and cost of communication. The equation monitoring communication frequency by distance between collaborators showed positive collaborative probabilities for near and relevant research fraternities.[5-7] However recent advances in communication speeds and the advent of interdisciplinary research in recent years have led to substantial changes in the proposed Equation (i) suggested by Kraut *et.al.*

$$y = 4.82+4.56 \times \text{distance} \times .459 \quad \{i\}$$ [4]

Y. F. Le Coadic uses a mathematical approach for studying the propagation of scientific ideas and operation and structure of science and technology information systems. They have shown information system to be a dynamic and orderly social system which exhibits impressive features of regularity and law within deterministic limits. It has also been observed that by formalizing the informal channels, the overall effectiveness of communication can be further improved. They have shown the evolution with time of the number of researchers getting an idea in the selected disciplines and fields. [8-13]

As Thomas Goetz explores the possibilities of open science from operating system and softwares to wikis and online journals, it clearly shows that open sourcing of ideas is eminent in all fields for a cognitive development. Ventures like Co-lab have been envisioned as successful beginning towards building an integrated approach for collaboration, modeling and inquiry. [14]

Also social networking websites in recent year have led us to believe in the power of developing a web based communication system. With the advent of online social networking as shown by Gross *et.al* people can communicate their ideas and thoughts to a wide audience of linked and relevant user. [15] However to promote a scientific ideas based on online networking we believe that a better mediator is needed to scan through relevant research and innovations by investors and effectively reduce search time.

Introduction

The paper discusses the possible effects and methods of target based sharing of scientific ideas and expertise through an online portal. Online portals are already in vogue for spreading ideas and social networking in the current form. The study points to modes of popularising the same and their respective outputs on the different segment of users. The study aims to aid any future development of scientific communication based websites and planning of promoting the same to target user bases with a focus on geographic factors.

The study is based on an online portal that caters to connecting innovations and research to potential users. Researchers register their novel idea in the online forum, with relevant details and relevant expertise in the area of the proposed work. Ideas are invited from broad spectrum of innovators, like school students with an innovative device to laboratories with cutting edge technologies. Prospective registered student researchers are connected to relevant research labs for towards developing feasible technologies.

Potential investors and companies can also register with the online portal and are kept updated with the relevant innovative ideas and research in their field of interest. Small and middle level companies which shun form buying expensive green technologies can connect to indigenous research labs for building alternate technologies. They are updated using a no-profit based peer reviewed system towards the merits of potential research proposal, towards an optimized decision based investment.

The website acts as a connecting media, between researchers and investors. It open sources innovative idea from grass root level to the cutting edge of science, presented to competing investors.

The novel effort aims in stimulating original scientific thought towards building greener technologies, and making them feasible by connecting to relevant investors. It also promises to make basic research pursued in universities and national laboratories to strive toward building technologies based on concurrent basic research relevant to their own expertise. Investors find a plethora of innovative technologies, from basic ideas to peers in respective fields, with a vast spectrum of investment towards developing technologies. It eliminates present practice of funding research only in peer reviewed groups at national laboratories and promotes small investors towards small practicable science initiatives.

We have studied the different modes to promote the same among different user groups of researchers, about the potential of different groups of researchers to contribute, and its impact on industries. The work gives a guideline for development in future promotion of scientific ideas through web based online portals.

The co-relation between the researcher i.e. innovator, intermediate website and the industry accepting the research are shown by a pictographical relation in figure 1. The figure shows possibilities of transfer of ideas and paper is aimed in studying how each factor adds towards successful transfer of ideas between R (Researcher /innovator), M (Intermediate online portal) and I (industry).

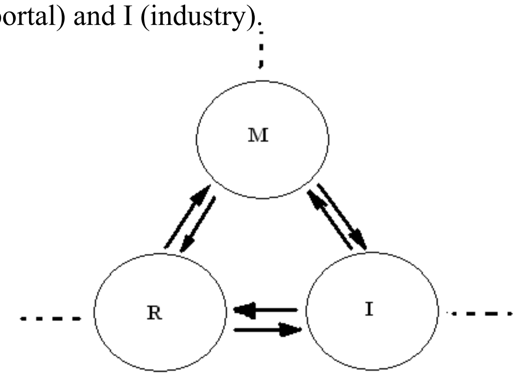

Figure 1. Knowledge transfer co-relation between Innovator, Intermediate website and Industry

Method

The methods of tabulating the following database and co-relations are based on a real time analysis of a said web based effort http://www.thinkbisoln.com for promotion of scientific ideas and their transfer to industrial and corporate solutions. The user registers online, supplying his innovation and expertise detail using an online form as shown in Fig 2. Questions marked with “*” are compulsory query fields. The analysis is based on real time data collected on the said website.

Information diffusion towards promotion of online site through different medium

For promotion of the said technology we have used different methods to convince to audience about its utility. This survey tabulates the diffusion of promotional information about the technology through various medium of communication i.e. online promotion, promotion at international conferences, journals, event sponsoring and trade pamphlets and catalogues.
After each promotional event was organised the number of users registering on the site was monitored using the mandatory third query in Section 4 of Fig 2 which gave source of promotional information about the said website for individual users.

1.Personal Data	
***First Name:**	
Middle Name(s):	
***Last Name:**	
***Birth Date:**	
***Nationality:**	
***Academic Title:**	
Scientific Discipline:	
Permanent Appointment:	Yes /No

2 .Institution	
***Current Institute:**	
***Address:**	
Webpage:	
***From Date :**	
***To Date :**	
***Exact Degree title:**	
Scholarships held :	

3. Research contribution	
Publication :	
Number of foreign publications:	
Average Impact factor:	
***Research Interest:**	

4. Solutions I want to provide: (200 characters)	
***What is your current level of work in the solution you want to provide: (200 words)**	
***Category**	Pharmaceutical Biomedical Biomechanical systems Green pathways Green software Green technologies
***How did you came to know about the site ?**	

Reference of Senior Academician who is mentoring/related with the project	
***Name :**	
***Academic title:**	
Webpage:	

Figure 2. Questionnaire to tabulate registered user's data.

The comparative study of flow of information from researchers based on expertise

Here we have done a survey of the registered user profiles. The systematic study uses the registered user's database of http://www.thinkbisoln.com as collected using the Form in Fig.2, to gauge the propensity of usage of online technological transfer websites along with a percentage of contribution. It was assumed that all age groups were equally susceptible to know how, about the presence of the site and information diffusion regarding promotion has an even distribution across age groups. The contributions were weighted using the Y. F. Le Coadic *et.al*. diffusion parameter based on t(timing), N(audience) constant for different medium.[8]

Media of communication	Technology	
	t	N
Journal publication	19	10,000
Patent	36	1,000
National conference	16	1,000

Figure 3. Diffusion Parameters by Y. F. Le Coadic *et.al*

The weighted value for each age group was called expertise and the contribution is defined as shown in Equation ii.

$$PC = (E \times PP \times 100) / \sum C \qquad \{ii\}$$

PC = Percentage of expertise, E = Expertise, PP = Percentage of profile and C = Contribution

Propensity of transfer of technology to industry

Different allied industries were questioned on their eagerness to accept innovations targeted as low cost alternatives to and tallied against the actual integration rate. This study shows the effectiveness of knowledge transfer with relevance to the industry. The surveyed industries are pharmaceutical, biomedical, green chemistry, green information technology, and waste processing industry. The differences give us an idea towards market opportunities and saturations for promoting research in relevant industrial sectors.

Analysis

Information diffusion towards promotion of online site through different medium

Information diffusion graphs plotted shows that rate of diffusion of information is highest in international conference, event sponsoring, trade catalogues, journals and online promotion in order of merit as shown in Fig 4.However the rate of penetrance is inversely proportional to the residence time. So for short term promotions International Conferences seemed promising as for longer impact time online promotion is recommended.

The comparative study of flow of information from researchers based on expertise

Expertise and probability of registrations are two most important factors that help web promoters to focus on target user groups. Here we have segregated users based on there age and have mathematically asserted the most prominent user group that should be targeted for online registration. The analysis shows peaks at age group twenty five to thirty five in terms of balance between web usage and relevant expertise. The expertise is calculated as a stochastic diffusion parameter with up to ten percentage error limit. With wider penetration of web usage across age groups the trend should tend to move towards the right of the curve.

Propensity of transfer of technology to industry

The survey shows the possibility of growth of innovation transfer in case of pharmaceutical, biomedical, green information technology and waste processing industry. However the green information based services seem to have the maximum growth potential among the surveyed industries. The green chemistry section shows a minor negative growth compared to predicted growth within stochastic limits hence has a saturated market.

Conclusion

The study clearly shows the possibility of advent of web based technology for promotion of open sourcing of scientific ideas. Marketing of the brand needs to be done with an overall balance between rate of promotion and

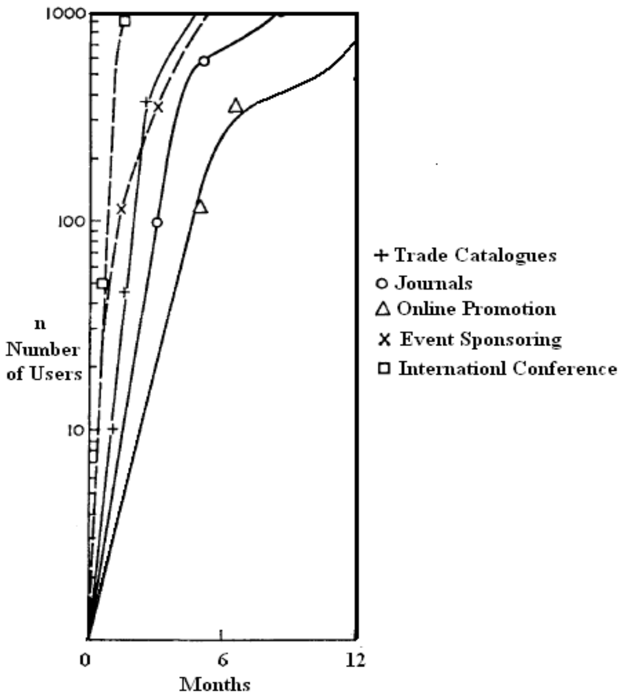

Figure 4. A survey of the information diffusion graph towards website promotion

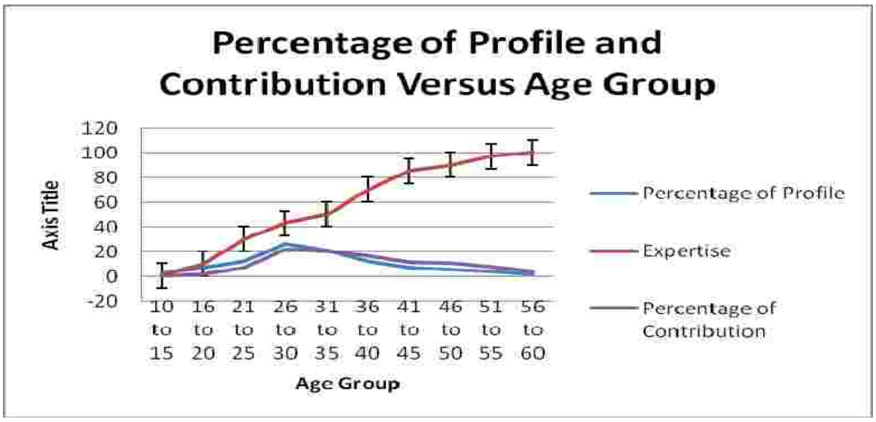

Figure 5. Comparative study of registered users and expertise

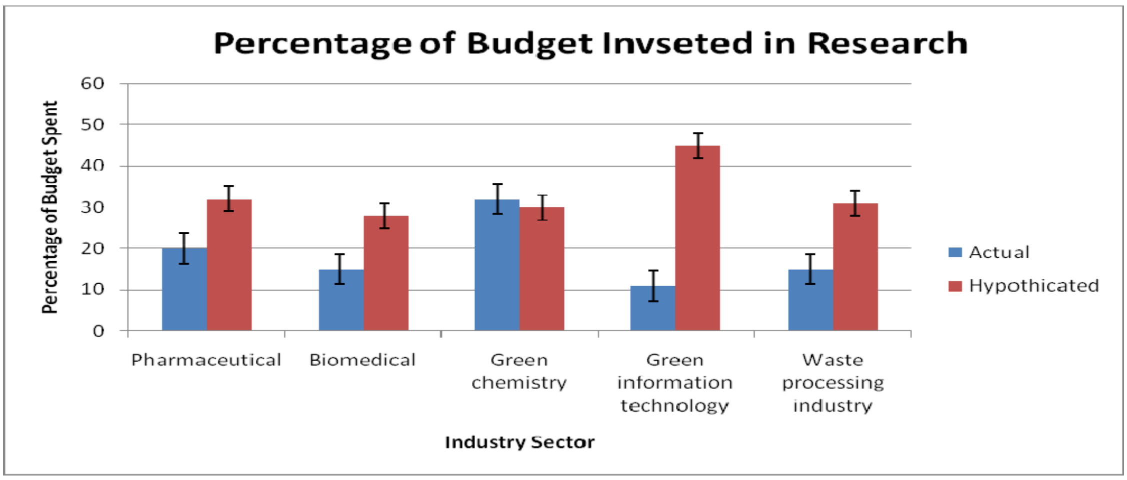

Figure 6. Propensity of transfer of technology to industry

residence time depending on the nature of promotion. The researcher database is prone to be most useful in the twenty six to thirty six years where there is a stable blend of expertise and openness to usage of the internet, prone to maximum contribution towards online innovation promotion. Multiple industries find scope for a web innovation transfer to grow with a higher propensity in areas like Green information technology and Waste processing industry.

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Muddying the waters or clearing the stream? Open Science as a communication medium

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Abstract. Open Science is an approach to the conduct of science in which the whole of an ongoing scientific investigation–data, ideas, questions, plans, results and more–is made available online. Open Science began as a way to facilitate the workings of multi-site and multi-national research collaborations but practitioners may choose to adopt it as much for philosophical as for pragmatic reasons. Conducting research as 'open science' has implications for research practice, peer-review, trust and reputation, publishing and access.

Open Science projects exist through and depend on the Internet; therefore they are potentially accessible to audiences–including public audiences–beyond the research groups that generate their content. Thus Open Science offers both a novel medium for direct, unmediated access to the process of science and an innovative method for scientists to communicate about their work live, unedited and in real-time.

Does Open Science clear the stream of communication through direct access or muddy the waters with unfocussed, unclear and unvetted comment? This paper will discuss recent analysis of data derived from interviews and case-studies to probe these issues more fully. The analysis suggests that adopting an Open Science approach will allow the capture of an authentic and clear record of research as well as increase and improve access to research outputs. However, researchers acknowledge that this involves opening themselves and their work up to a different quality of scrutiny. For researchers, Open Science both enhances the development of collaboration and communication among research groups and is a way for publicly-funded researchers to meet their responsibilities to communicate with the wider public. Open Science can allow members of the public to contribute directly to research although the need for contextualisation of complex science may place demands on researchers' time and skills.

A Model of Evaluation on Large-scale Science Communication Events

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Abstract. Based on the evaluations of the China Science Communication Day at the Beijing Venue in 2007, 2008 and 2009, undertaken by the China Research Institute for Science Popularization, a comprehensive model designed to evaluate large-scale science communication events was developed. The evaluation, composed of four parts (public evaluation, organizer and volunteer evaluation, specialist evaluation and media evaluation) is a combination of both qualitative and quantitive study. It is supposed to be applied to a science communication event with both traditional displays and modern hands-on exhibits and activities. The evaluation focuses mainly on measuring the effects of the science communication event. It also concerns the forms, content, on-spot services and promotion of the event, all of which are considered to be relative to the effect of the science communication event. The public evaluation is designed to acquire the public's feedback to the science communication event. On-spot questionnaire survey, call questionnaire survey, observation and interview are all adopted in the public evaluation. The on-spot questionnaire survey, subsidized by observation and an interview, aims to chart the event's influence on the public and the public's positive reaction to the event. Also, any comments or preferences on the forms and contents are noted and the details regarding how individuals were initially made aware of the event are transcribed. A call questionaire survey is also utilized to attain the public's level of awareness. The organizer and volunteer evaluations mainly focus on staff comments and suggestions regarding the organization of the science communication event and its undertaking in general. It also investigates what skills or knowledge the staff acquired after such communication with the public and, furthermore, inquires as to what the staff considers the public's preference regarding the form and content of the event to be. The questionnaire survey and interview are adopted in the organizer and volunteer evaluation. The Specialist Evaluation is designed to attain suggestions and comments regarding the science communication event (concerning mainly the construction of the event) from about 10 professors and engineers who specialize in fields related to science communication, science education or a field related to the theme of the event itself. A group interview has proven an effective way to evaluate. The Media evaluation examines how newspaper, TV, radio and the internet report the science communication event, and aims to find effective ways to improve the public's awareness of the science communication event.

Keywords: Evaluation, Model, Large-scale, Science communication event

Effectiveness of Participatory Approaches for Science Communication Strategies: A Comparative Study in Taiwan and Japan

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Abstract. Public Understanding of Science and Technology (PUST) has been addressed and implemented in Japan since 2002 in Biotechnology Strategy Guidelines Japan (BT Japan). The BT Japan has clearly demonstrated to improve public engagement for science literacy in the general public in Japan. In response to White paper, there are various kinds of activities organized by different stakeholders such as governmental organizations (GO), governmental organizations (NGO), academic or research intuitions, and private sectors in Japan. Currently, Taiwan is still lacking of long-term science communication strategies or public engagement on S&T mechanisms. PUST or “science communication” is just at the beginning stages for Taiwanese stakeholders, particularly the governments of Taiwan. They are in the progress to establish S&T policies to improve science communication, including public engagement and understanding of S&T etc.

This paper reviews the current status and addresses the challenges and requirements it faces in implementing science communication strategies in Taiwan and Japan, by analyzing the following issues: (1) science communication strategies under the framework of biotechnology policies, from the policy to practice; (2) summaries the current public engagement activities by different stakeholders, particularly on participatory approaches; (3) science communication education/training programs in higher education. Based on review results, it compares status of Taiwan and Japan.

Overall, this paper proposes long-term strategies to improve two-way science communication in Taiwan, particularly the effectiveness of participatory approaches by referring from Japanese experiences and a polite study of Taiwan Science Café in 2006. It is partly to respond to the recommendations of S&T policies in Taiwan. The proposal includes the possibility of developing a model for public engagement activities that incorporate the needs of different stakeholders to achieve public literacy and understanding of S&T by informal learning system for the general public. This proposal is not only related to science communication strategies but also the issues of capacity building for science communication and its roles in different cultural societies.

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Keywords: Participatory approaches, Science & technology policy, Science communication strategies, Taiwan, Japan, Comparative study

Learning Mathematics Through Origami

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Abstract. In our schools, mathematics is a dreaded subject, perhaps even more so than other subjects like physics, chemistry and biology. One reason for this, it is believed, is that whatever is taught in the name of these subjects has little or nothing to do with real life. Experience has shown that once a clear link can be established, the teaching and learning of the subject at once becomes agreeable and enjoyable, the dread dissolves and children start loving it.

Today school mathematics is totally cut off from real life. The entire curriculum seems to be overlaid. In this process the entire delight and beauty of mathematics has got buried. Today, any school worth its salt, would boast of a physics, chemistry and biology laboratory-all agleam with the most modern gadgetry. Rare is a school which has even thought of having a mathematics lab. It is thought that mathematics is best learnt by mugging up tables and by repeatedly solving boring sums. Most of the children are scared of mathematics and carry the burden of it through precious years in school. If children are to appreciate the beauty of mathematics, it is imperative, that they get a feel for mathematics through practical work.

Origami is the Japanese art, the meaning of origami Ori = to fold & Gami = paper, simply we can say, origami is nothing but the paper folding. By systematically folding a paper, one could fold lots of angles, polygons, curves and 3-D polyhedral, by this method one can learn a lot of concrete mathematics.

For origami no special paper required, however stationary shops cell origami papers, which are thin sheets of paper colored on one side, that are squares of different colors, stacked together in packets. But for models ordinary paper will sufficient. Even computer stationary, printed on one side can be used. Discarded photocopy paper can also used as Origami paper. Origami is also a fun-filled activity in itself as well as an approach to enhancing one's mathematics especially geometrical thinking while developing co-ordination between one thought and action.

Values and Evaluation: Observations of Emergent Engagement

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Abstract. Use of the term "engagement" in science communication has arguably become the fashion of the times. But while the motivations for, and intended outcomes of engagement have been discussed widely, the value of engagement activities is difficult to demonstrate. I argue that this issue is reflected in the difficulties encountered in the evaluation of these activities and suggest that for an engagement process to be truly participative, participants should also be included in establishing the value of (i.e., evaluating) the activity.

In this paper I will provide an exploratory account of a particular instance of emergent engagement—the formation of a group of farmers called Climate Champions. The Climate Champions program was established in recognition of the role of peer interaction in how farmers gain new knowledge and adopt new practices. It aims to put farmers who are knowledgeable about managing and adapting to climate variability and climate change in touch with other farmers. As part of the initial meeting of the group, participants discussed and established their own values for the program.

This research raises two sets of questions that I will consider. First, how can focus groups and conversation transcripts be used in value oriented science communication research? Second, how can values be used to guide further engagement work in evaluation? Through the Climate Champions example, I will explore how engagement processes might be used for soliciting and including values of those who participate. I will discuss the potential effects of facilitation and transcript analysis techniques and the implications of value awareness in engagement activities more generally.

Popularising E-Governance for Development

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Abstract. This paper is a brief introduction to the concept and process of e-governance (Electronic Governance) for which innovativeness in the approach and methodologies are significantly required. E-governance is the application of Information Technology to the processes of Government functioning to bring about simple, moral, accountable, responsive and transparent governance. E-Governance' is a network of governmental or non-governmental organizations or a one stop portal that changes the system of delivery of public services and increases the inter connections between the people and government. This process would be successful only if science and technology is popularized. Necessarily it must be popularized among the students, who are the future of nation.

India is a agricultural country. So far the agricultural sector is concern, e-governance refers to the use of ICTs in delivering governance products and services which are of use to farmers or those working in the agrarian sector, including livestock breeders and herders, milk dairy workers, agriculture extensionists, agricultural traders, and NGOs working in the agriculture sector. At the same time, there are a range of governance products and services that are useful for the agrarian community, which lead towards enhancing crop productivity, efficient cattle farm management, providing for national and household level food security, and conservation of biodiversity.

Hence, there is a need to take a holistic view towards the entire e-Governance initiative across the State. To ensure successful application of e-Governance, Government of India has setup an institutional mechanism for formulation of Standards through collaborative efforts of stakeholders like Department of Information Technology (DIT), National Informatics Centre (NIC), Standardization Testing and Quality Certification (STQC), other Government departments, Academia, Technology Experts, Domain Experts, Industry, BIS, NGOs etc. Therefore, the paper tries to examine all significant efforts to popularize the process of e-governance among every sections of the society i.e. farmers, students, administrators, corporate and what not.

The Analysis of Social and Cultural Factors in Science Communication

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This paper analyses the roles of social and cultural factors in science communication, and this paper point out: science communication is deeply influenced by social and cultural factors. Science communication is influenced and restricted by philosophies in society, social customs, social mentalities, social concepts, men's modes of thinking, moral values, habits and customs, way of behaviour, and so on. They often affect and restrict the way, method, direction, channel, aim, content, process, result of science communication, and so on. The process of science communication deeply bears the stamp of social and cultural factors.

Keywords: science communication, social and cultural factors, analysis

People's Perception of Public Participation in Regulatory Decision Making: The Case of Bottled Water Quality Standards in India

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Abstract. The theories on public engagement in scientific and regulatory decision-making have changed rapidly during the last two decades. The regulatory decision making processes, which were completely in the domain of expert's knowledge, have come under severe attack from social scientists, politicians, journalists, and public intellectuals. Questions over 'participatory gap' have been raised by several scholars. This framework follows the pluralist precautionary approach and argues for giving considerable weight and space to non-scientist and other actors in regulatory decision-makings. The debates over public engagement become more intense in the context of genetically modified foods, stem cell research, reproductive cloning, climate change and other contentious issues. In this regard, government policies and participatory mechanisms vary across countries.

Scholars, engaged in quantitative studies on regulatory decision-making processes have propounded the 'deficit theory' which accounts that people do not have enough and proper understanding of technical and scientific issues. This view has been criticised by scholars in later studies. The alternative views propound that people do have the capacity to grasp the implications of many scientific and regulatory decision-making on their day-to-day life. Non-scientists and laypersons decisions become more crucial, on the issues, where the experts themselves were not very certain about the risk generated from scientific and technical problems. Thus, the incorporation of decisions of other actors makes the process pluralistic, transparent, and democratic in nature, and leads to greater acceptance of regulatory decisions in democratic societies.

In this background, this paper explores the regulatory decision making process for setting quality standards of bottled water in India. The paper also attempts to explore the public understanding of regulatory decision-making and their opinion over expert's committee composition. Through primary survey, the study explores three basic premises: the awareness of people towards regulatory bodies and its implications over their decision-making, their willingness to participate in decision-making process and their perception of the composition of the expert committee.

In the study it was found, that majority of the respondents were aware about the regulatory body. Apparently, the scientific and technical parameters used by BIS for setting quality standards do not connotes much meaning to them, and perhaps, they trust other parameters to judge drinking water quality. Here, it was also found that people were highly willing to participate in the decision making process of standards setting. The individuals in the least educated category were more willing to participate in the standard setting exercise. Where as, people belonging to the highest category of education want to leave it to the 'experts'. This suggests that people perception over scientific authority and validity varies across different sections of society. Over the issue of composition of expert committee for setting standards for bottled water, it was found that people posed more faith in government and consumer organisations. Only thirteen per cent of the respondents felt that there is a need to have representatives of industry groups in the expert committee. This is in sharp contrast with the present composition of these regulatory bodies where around forty percent experts are industry representatives.

Choosing Effective Frames to Communicate Animal Welfare Issues

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Abstract. Animal welfare organisations use multiple communication frames, but it is unclear which ones are most effective in promoting attitudinal and behavioural change. This paper reviews framing techniques that draw on shocking imagery, measures of animal intelligence, societal norms and celebrity promotion. Societal norms and celebrity promotions have the greatest potential to modify attitudes and behaviour as they are accessible and relevant to the general public, unlike frames promoting animal intelligence. Shock frames are also effective, but should be avoided as they may provoke audience backlash and reduce the credibility of the organisation.

Keywords: Animal welfare, Celebrity, Framing, Social norms

Introduction

Most societal and scientific issues can be approached from different viewpoints, emphasising different values and considerations of the same essential argument. Choosing a single viewpoint for communicating an issue is known as framing and can have significant effects on the way in which the audience responds (Chong & Druckman, 2007). Animal welfare is a good case study for studying the influence of framing, as it is an issue that has an extremely broad potential audience who hold conflicting values and viewpoints.

Animal welfare is highly valued by the general public (Bennett, 1998), but most people lack knowledge about specific welfare topics (Tawse, 2010). In theory, this means that there is a large audience who are prepared to act on animal welfare issues if the relevant organisations can communicate their message effectively.

It is important to note the difference between animal rights and animal welfare. Animal rights philosophy argues that animals have rights and should therefore not be used by humans for any purpose (Regan, 2004). Animal welfare considers animal use acceptable as long as it is done humanely (Carenzi & Verga, 2009; Dawkins, 2006). For example, an animal rights activist might boycott meat entirely, whereas a person who values animal welfare may seek out free-range products rather than factory farmed animals. This more moderate viewpoint asks people to make small changes to their consumer behaviour, a much realistic communication goal than the major lifestyle changes required by animal rights groups (Mika, 2006).

Both animal rights and animal welfare societies have a long history of using shocking images to raise awareness of animal suffering. For example, past advertisements have included graphic depictions of face-branding cattle, euthanized animal shelter kittens, and blood pouring from a fur coat (Jones, 1997).

Yet shock tactics may be counterproductive, distressing viewers but leaving them unwilling or unable to act on their emotions. This effect has been observed in climate change campaigning, where negative fear-laden frames are thought to disempower the audience and fail to encourage deeper engagement (O'Neill & Nicholson-Cole, 2009). Likewise, humanitarian charities are finding that people can become overwhelmed and seek to justify their apathy by questioning the validity of aid organisations (Seu, 2010).

Negative framing in political advertising has been shown to produce a backlash against the attacker (Jasperson & Fan, 2002), but even more of a concern is that long-term negative campaigning can reduce public trust in the government and the political system (Lau, Sigelman, & Rovner, 2007). Consequently, it is important to consider whether shock frames are a useful tool for animal welfare activists or whether their continued use may lower the credibility of the entire movement.

Thus, the aim of this paper is to review common frames in animal welfare and develop predictions of their efficacy.

Animal Welfare and Moral Shocks

Animal rights activists and previous researchers have concluded that shock tactics are their most powerful tool, eliciting audience attention and prompting action. University students exposed to depressing, negative images of dogs were willing to donate more money and time than if exposed to a warm, happy dog (Haynes, Thornton, & Jones, 2004). Jaspar and

Poulsen (1995) found that most members of animal rights groups were recruited through shocking images and literature.

However, there are some important drawbacks to using a shock frame. Apart from the fact that overly explicit images are frequently banned or refused by advertisers (PETA, 2010), shock frames may only appeal to a limited segment of the population. Animal rights groups are predominantly made up of women – over 70% in most groups (Herzog, 2007) – who are non-religious college graduates (Jasper & Poulsen, 1995; Mika, 2006). The frames which are effective for this group may alienate others (Mika, 2006).

Many consumers may simply avoid or switch-off to advertisements that they find emotionally distressing. Studies demonstrating the effectiveness of shock frames are normally conducted on captive participants (eg. Haynes, et al., 2004), but a more realistic situation is described by advertising creative director Andy Firth who said,

> *You can see animal welfare ads a mile off. A sad looking animal and you already know what it's about. Consequently, you choose not to read it. You already know how it will make you feel*. (Duncan, 2008)

The counter productive nature of shock tactics has been observed in animal welfare campaigns. Mika (2006) looked at morally shocking advertisements for vegetarianism and found that non-activists had a nearly unanimously negative reaction. Many people were offended and expressed reduced support for the advertiser.

In summary, negative shock framing may be effective at attracting attention, but also risks alienating large sections of the audience. As such, it is only a worthwhile communication strategy if there are no viable alternative frames.

Framing Animals as Intelligent Beings

One strategy growing in popularity amongst animal welfare organisations is to frame animals as intelligent beings. The information used in these frames is normally based on sound, scientific research in animal cognition. For example, the Animals Australia 'Free Betty' campaign against battery eggs states that a chicken, 'can recognise over 100 of her friends by their facial features' and that her calls, 'communicate a wealth of information' (Fig. 1); both claims are supported by research (Bradshaw, 1991; Evans & Evans, 1999).

Although the Free Betty campaign still makes use of graphic imagery, the dominant frame is that chickens are intelligent and therefore worthy of our care. This line of thinking is also popular in the scientific literature. The argument runs that suffering can only be present if you are consciously aware of it. Therefore, we do not need to be concerned for the welfare of animals that do not experience pain and have low mental capacity. Once there is reason to suspect that an animal is sentient than we have a moral imperative to safeguard their welfare (eg. Broom, 2007; Brydges & Braithwaite, 2008).

On the surface, the lay public seems to agree with the scientific consensus; people who have a higher level of belief in animal intelligence are less likely to support the use of animals by humans (Knight, Vrij, Cherryman, & Nunkoosing, 2004). However, evidence suggests

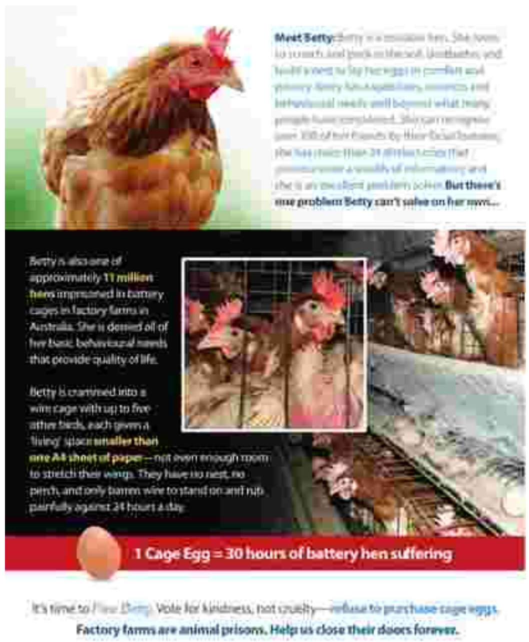

Figure 1. Animals Australia (2009) 'Free Betty' campaign framed chickens as intelligent and worthy of our care.

that people attribute intelligence to animals they already like, such as cats and dogs, but do not necessarily decide to protect animals they discover to be intelligent (Knight & Barnett, 2008).

People who deal with dilemmas about animal intelligence, such as working with laboratory rats while simultaneously keeping a pet rat, may even justify their behaviour and reduce emotional conflict by crediting some individuals with being special or smarter compared to the rest of the species (Knight & Barnett, 2008; Serpell, 2009).

Effective frames are easily accessible and resonate with the existing beliefs of the audience (Chong & Druckman, 2007). The frame of farm animals as intelligent creatures meets neither of these criteria; it is an unfamiliar concept to most people and contradicts popular beliefs. Additionally, people seem to be adept at mentally manipulating information about animal intelligence to suit their behaviour.

Despite this, there is evidence to suggest that long-term promotion of intelligence frames, coupled with educational programs, can change social perceptions of some species (Goedeke, 2004). However, if this is the ultimate aim of the communication strategy then it might be more efficient to target social norms directly.

Framing Animal Welfare as a Social Norm

People usually behave according to their beliefs about what is considered normal and acceptable within society (reviewed in Cialdini & Goldstein, 2004). Social norms are a powerful driver of human behaviour, affecting everything from participation in recycling to reducing binge drinking and the extent of their effects are probably still underestimated (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008).

Because norms are important for building relationships with others and constructing self identity (Cialdini & Goldstein, 2004) they are immediately accessible and relevant to an audience, making them an effective communication frame (Chong & Druckman, 2007). For example, the most important factor in determining if dog owners would take part in recommended activities such as obedience training were their beliefs about the expectations of friends and family (Rohlf, Bennett, Toukhsati, & Coleman, 2010).

Social norms are also important for influencing donations; men gave more money to a public radio station when they received descriptive information about the amount most people gave (Croson, Handy, & Shang, 2010). This is potentially important for animal welfare organisations as men are generally less sympathetic to animal welfare compared to women (Herzog, 2007). Men and women also differ in the type of animal abuse they engage in, with men more likely to violently attack animals while women more often hoard and neglect animals (Herzog, 2007). It may be useful for animal welfare organisations to separate these aspects of animal abuse and run campaigns using social norm framing to target men and traditional shock frames to target women.

The RSPCA is one of the most credible and well-known animal welfare organisations in the UK and Australia (Hughes, 1995). Their advertisements emphasize the social acceptance of animal welfare goals and encourage people to become a supporter (see Fig. 2 for an example). Like many social movements, animal welfare and rights are heavily involved in Web 2.0 and internet networking which provides them with a cost-effective method of reaching a broader range of people (Loader, 2008). There is little information on how internet communities provide information and construct social norms. However, recall of political information was increased in students who friended a politically-orientated profile on Facebook (Teresi, 2009).

Celebrity-based Frames

Another aspect of social norm framing is the use of celebrities as role models and promoters. It is accepted within the advertising industry that associating a product with well-known and attractive celebrities can increase sales (Amos, Holmes, & Strutton, 2008). The key factors in determining the success of a campaign are the credibility of the celebrity and that the celebrity and product are well-matched (Till, Stanley, & Priluck, 2008). Both factors are important in ensuring the frame is accessible and pertinent to the audience.

Figure 2. The RSPCA (2009) frames supporting their organisation as a social norm.

PETA is especially renowned for using celebrities (eg. The Daily Telegraph, 2010) but the effectiveness of their approach is questionable. Going for quantity over quality, PETA celebrities often have no direct link to animal welfare and are portrayed in a sexualized fashion. This has raised questions about the credibility of the organisation and generated feminist debates (Deckha, 2008).

A better example of effective use of celebrity can be seen in Jamie Oliver's television phenomena 'Jamie's Fowl Dinners' and the follow-up 'Jamie Saves Our Bacon' (Klein, 2009; Van Someren & Ward, 2008). As a celebrity chef, Jamie Oliver is well matched to encourage consumers to cook using free-range animal products (Gerodimos, 2008). News outlets hailed 'Fowl Dinners' as an unqualified success, claiming it increased sales of free-range chicken by 35% (Hickman, 2008). Although it is yet to be shown whether the impact was long lasting, consumer associations with celebrities are thought to be memorable (Till, et al., 2008).

Discussion

Animal welfare groups have traditionally used shock frames to mobilize support, but there is increasing concern that this approach alienates the public and reduces organizational credibility. Frames focusing on social norms and celebrities are likely to be the most effective frames for encouraging positive attitudes and behavioural change. Both these frames are immediately accessible and relevant to the general public, unlike the frame of animal intelligence.

The next logical step for research is to test these predictions using field testing and experimental manipulation of frames. Such an experiment would have to be carefully designed; even simple manipulations of an image can have unexpected effects (Haynes, et al., 2004), while preserving an image and changing the framing text can lead to a disconnect between the words and the visuals (Nabi, 1998).

This study has important implications for the broader field of science communication. Communicators should be aware that, although they are effective, negative frames can result in audience backlash when employed for long-term campaigns. We also note the potential role of Web 2.0 social networking in the formation of social norms and an urgent need for research in this area.

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BioSense Project as a Dialogical Model

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Abstract. Effective engagement of science with its publics requires: (1) that publics actively appropriate the resources provided by science for more robust capacity for active citizenship; (2) the engagement of scientists and scientific institutions with publics on a collaborative basis for addressing science and technology-based concerns. Our project aims to create the conditions for scientists to understand the plurality and diversity of publics whom they are expected to engage with, as well as developing the capacities and skills required for a constructive interaction for dealing with publicly relevant issues. We will use Science Shop models, which have been part of the landscape of the public engagement with science in many European countries and beyond and that have been a very important means of democratisation of science. The diversity of experiences in this field provides a very rich repertoire of organisational models, initiatives and modes of articulation of the concerns of scientists and scientific institutions and different kinds of publics. However, the experience of Science shops is unevenly distributed across countries, and Europe is not an exception. Portugal is a conspicuous case of absence of experience with science shops. In this project, the science shop will be thematically oriented towards issues related to the life sciences in society. It is expected to address both issues in biological and biomedical research that are matters of public concern and controversy (through the organisation of debates, deliberative *fora*, online *fora* and exchanges, performances and exhibitions), and issues raised by specific publics, such as matters of food safety, animal welfare, public health, health care or reproductive health. The institutions involved in this project are active in the fields of the life and biomedical sciences and of the social sciences, with a standing commitment to the development of science-society relationships, based on transdisciplinary approaches bringing together the life, biomedical and social sciences and the arts. This will be achieved through the creation of an infrastructure for the continuing support of the work of the science shop and for communication; the identification and “interessment” of a variety of publics; the training of mediators/facilitators for science shop activities; the development of pilot activities as a “demonstration effect” of the potential of science shops for promoting science-society dialogues and collaborations; and the dissemination and sharing of experiences with a view to encouraging and supporting the development of other Science shops.

Mentoring Network Model and Evaluation Scheme

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Abstract. Little is known about the evaluation scheme of measuring how successful a mentoring is. There are no tools of success factors for formal mentoring program. In this presentation we introduce the Mentoring Network Model (MNM) based on a formal mentoring program at the WISE (Women into Science & Engineering) Main Center at Ewha Womans University.

The Mentoring Network Model (MNM) is a visualizing model to represent the human networks among mentors and protégés by using a network diagram. The model contains not only people participated in the mentoring but also all members' relations such as friendship, alumnae, colleagues in the same organization, and neighbor.

By assigning three factors- node, relation and field to the MNM, we analyze the MNM. The nodes represent members and relations between two nodes are expressed by a line and the field is the physical or virtual area representing nodes and the relation in a 2-demension rectangle. If some mentors are belonged to same department of an organization, they can be assigned in same field.

We introduce three indexes- affinity, time and grid-complexity related to the relation of MNM. *Affinity* (A) is an index for affinity between two members. The affinity is based on the age gap, locality, and personality. We assume the closer network, the better condition for mentoring. The second index, *time* (T) represents the quantity or time of mentoring activities. We assume the more frequent on-line and off-line interactions between two persons make the index T bigger. The last index, *grid-complexity* (G), is a complexity index that shows how many relations per node exist in a model. By defining three factors and indices to MNM, we introduce an evaluation scheme how successful the mentoring is. We apply this MNM to WISE mentoring fellow program.

Keywords: Mentoring model, Mentoring network model

SERI–Information Kiosks–Science Communication and Beyond

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Abstract. In this Information Technology age, most of the people in the developed countries and a substantial section of the population in the developing countries like India access the internet to seek information on various subjects, thanks to the information and communication technologies (ICT). But, In many developing and under developed countries, there is still a substantial number of people who have no access to such technologies as a result of which they are disadvantaged in their access to information. This is specifically true in case of farming community. And Sericulture and Silk industry are no exception to it. The phenomenal growth in silk production in the country during last two decades was largely due to the series of research breakthroughs made by various research organizations of the Central Silk Board like, evolution of productive bivoltine silkworm breeds/mulberry varieties, appropriate rearing technologies for bivoltine races and cross-breeds, package of practices, etc. Though, Central Silk Board and state Departments of Sericulture of different states are actively involved in taking such technologies and recent findings to the stakeholders through their extension networks effectively, yet in order to strengthen the extension network through IT initiatives Central Silk Board developed Seri-information Kiosks in English and regional languages. These touch screen kiosks have helped sericulturists to access sericulture and silk related technologies/information actually on finger tips! They mainly provide information on new mulberry varieties; silkworm races; packages of practices; diseases/pests and their control measures; seasonal forewarning; reeling; wet processing; weaving; training programmes; projects/schemes; market information; details of manufacturers/dealers of sericultural appliances/ chemicals, etc. The market information on cocoon and silk at designated markets is updated on day to day basis. These Kiosks have been already working in few selected sericultural states successfully. The farmers have been utilizing these touch screen kiosks for their requirement. Still efforts are on by the CSB to bring in these units under on-line connectivity for updating the market rates of cocoons and silk on hourly basis. Now, efforts are being made to put these kiosks on interactive mode, connecting the stakeholders with the Research Institutes of the CSB and Departments of Sericulture.

Keywords: SERI-information Kiosks, Information and Communication Technologies, Sericulture

Virtual and Substantial Vectors in Science and Technology Museum— Comparison and Analysis of Chinese and Foreign Popular Science Exhibitions

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Abstract. With the development of world science and technology, global exhibition educational programme has entered into a new era. Currently, among 186 countries in the world, Europe, America, Japan and other developed countries have utilized the “4D virtual imaging” as one of the important methods to popularize the science technologies and social conventions. The trend will be completed in a relatively high speed as a consequence of time lapsing and explosive updates in technologies. It can be forecasted in the future. Virtual technology will not only coexist with the entity exhibition but also become a primary educational method.

This paper compares Chinese and Foreign science exhibitions from the aspects such as: the exhibition theories, designs, contents, and the building of circumstances. Try to find the flaws then correct them. At the same time, we have browsed the world famous virtual science and technology museum network, such as New York Science and Technology Museum, Washington Science and Technology Museum, US Astronaut Science and Technology Museum, Lincoln Memorial and so on. Using statistics to do our research. Meanwhile, we combined these with the reality of our country, analyzed the differences in science technology vectors; audience groups and communication effects. In the future, how to take advantage of new technology to complete science enterprise should be emphasized.

Nowadays, science and technology museums should attract visitors by using novel exhibition methods, The museums can make them perceive the technology and experience the technology from a total different aspect of view. For the purpose of revealing the uniqueness of science, the meanings can not be limited but should be renewed continuously to touch the audiences’ senses. The author believes that the combination between virtual and substantial technology is the only path develop in the future.

New Frontiers in Science Communication: Researchers' Experiences of Coming Out of the Laboratory

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Abstract. What happens when researchers come out of the laboratory and explore new frontiers in science communication? This question is explored here by considering a series of case study projects within the UK linked together with the common theme of robotics technology. We will discuss what the researchers brought to the project in terms of audience engagement and the impacts on the researchers as a result of their involvement.

Robotics technology was specifically chosen as the focus for investigation since robots are frequently perceived as exciting and intrinsically compelling, therefore as a subject area are a low barrier when communicating with public audiences. Activities can range from basic physical and engineering processes and hands-on building workshops to demonstrations using state-of-the-art components from robotics research or industry. In more recent times robotics-related public engagement events have also included consideration of the social and ethical questions that arise from robotics research.

In late 2006 the UK Engineering and Physical Sciences Research Council funded *Walking with Robots*, a network which provided focus and support for robotics researchers, enthusiasts and representatives from UK industry to engage public audiences with their work. A variety of flagship projects and events developed out of this network, often with very different approaches and outcomes but each, at the core, about direct contact between those at the cutting edge of robotics technology and a public audience. This paper will contrast the findings from the *Walking with Robots* programme and three of its associated projects: *Heart Robot* (a fusion of robotics and buraku puppetry to engage audiences at carnivals and street theatre); *Robotic Visions* (a UK wide youth engagement project); and a training programme aimed at early career researchers in robotics.

Public audiences often reacted very positively to the fact that those delivering the activities were researchers or scientists, and on many occasions would identify the involvement of a scientist or engineer as the 'best part' of an event or activity. Impacts on the researchers were varied. For some, taking part in a project or an event meant being part of a rewarding experience that reinforced existing positive feelings and enthusiasm about public engagement. Others met new contacts, learned new skills or became familiar with novel approaches to public engagement. Others heard ideas about robots from outside of their normal working environment, or developed a greater understanding about what audiences think and feel about robots which provoked wider discussion back at the laboratory. In some cases involvement in the science communication projects has prompted researchers to reflect on their motivations for taking part in public engagement activities more widely. In considering the wider learning from researchers' experience in a robotics context the paper will reflect on how that might apply more generally to researchers involved in direct contact with public audiences.

A Study on the Application of Knowledge Management to Raise the Effects of Science Communication–A Case of Training and Education in Science Centers & Science Museums

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Abstract. By now, many enterprises have implemented knowledge management (KM) and achieved remarkable success. According to the theory of KM, knowledge can be divided into explicit knowledge and tacit knowledge. Explicit knowledge is knowledge that has been or can be articulated, codified, and stored in certain media. It can be readily transmitted to others. The most common forms of explicit knowledge are manuals, documents and procedures. As opposed to explicit knowledge, tacit knowledge is knowledge that is difficult to transfer to another person by means of writing it down or verbalizing it. The most common forms of tacit knowledge are know-how, discernment, intuition, comprehension, belief, ideals, values, emotion and mental model.

In Science communication, scientific knowledge belongs to explicit knowledge, whereas scientific spirit, thinking and methods belong to tacit knowledge. Tacit knowledge is more important and difficult than explicit knowledge in the process of science communication. Because training and education in science centers & science museums (TESCSM) is a kind of science communication , it is taken as an example in this paper to demonstrate the necessity and measures of the implementation of KM.

With rich contents, science centers & science museums provide different training and education for different people such as children, pupils, volunteers, teachers from middle school and primary school, staff from science centers & science museums. The benefits of KM are as follows:

1. Improving the professional ability of teachers;
2. Increasing the study results of students;
3. Assisting students to master scientific knowledge, scientific spirit, thinking and method better.

To obtain these goals, the following measures should be put into effect well:

1. Tacit knowledge communication between teachers;
2. Tacit knowledge communication between students;
3. Tacit knowledge communication between teachers and students;
4. Personal knowledge management;
5. Turning personal knowledge into organizational knowledge;
6. Constructing the network of knowledge sharing.

The paper will discuss those problems in detail and draw a conclusion that the implementation of KM in science communication can raise its effects.

Scientific Conversations Outside Science Programmes Contexts: A Case Study Analysis

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Abstract. Several excellent articles and books have been written in the last decades on the analysis of science programmes of traditional media. Throughout the years scientific programmes of radio stations and televisions all around the world have been studied and observed with methodologies coming from different fields of social research, while international networks and forums of science journalists where successfully created. This research presents an attempt to focus on a new type of interaction which still takes place in traditional media programmes but escapes traditional contexts of scientific programmes.

Starting from a previous general study on the presence of science in Catalan television this new research has been deepening into the analysis of interactions which occur in a magazine programme called “Els Matins”, broadcasted by the main Catalan public channel (TV3). The programme has turned out to be an extremely interesting case study when it comes to science communication as it presents a great variety of actors and interactions whenever dealing with science topics. Being broadcasted every day from Monday to Friday, from 8 am to 1 pm, the programme sees the two presenters going through a series of interviews, debates, news and weekly sections that often involve science topics taken from a variety of fields.

Using the methodology coming from the field of Discourse Analysis, and in particular that of Conversation Analysis, the author has been studying and comparing two main types of interactions which occur inside “Els Matins”: the one between the presenters and the invited scientist, which takes place weekly and has a duration of twenty minutes (“Ciència amb Ramon Folch”); and the one between the presenters and the variety of invited guests (such as politicians, researchers, civil associations, citizens, lawyers, etc.) who participate almost daily in interviews and debates on scientific topics – between others. Due to its nature the programme has the tendency to often deal with (but not only) scientific topics which are strongly related with everyday life or to important ethical and political issues. This happens both inside the general debates and in the specific section dedicated to science (i.e. issues related with the advancement of the health system as well as ethical issues in medical research, local environmental problems such as the scarcity of water supply, public funding to scientific research, etc.), which made such a case study even more interesting to analyze.

The work has underlined the importance of studying also the scientific discourse happening outside specific and dedicated contexts - such as science programmes - even when analyzing traditional mass media. It shows how the proximity between the public and the scientific topics/problems/dilemmas/hopes and controversies (through the mediation of the journalists/presenters) increases considerably when dealt with outside specific “media spaces” labeled as science spaces. Relevant results emerged through the analysis have shown how interactional occasions which occur in more general spaces can generate more effective and interactive discourses than one-way interactions that occur inside specifically dedicated spaces.

Perception of Coordinators of Graduate Programs in Public Health about Public Science Communication

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Abstract. Bibliometric, scientometric and infometrics studies indicate that Brazilian scientists and researchers are increasingly communicating the results of their research using scientific indexed publications. Factors contributing to this reality are the relatively recent increase in the number of new peer-reviewed journals published in Brazil in the last years, and due particularly, since 1997, to the creation and development in Brazil of the Scientific Electronic Library Online (SciELO). With SciELO was created new mechanisms for evaluating scientific publications, complementary to the traditional Institute for Scientific Information (ISI) and spent to produce indicators of use and impact of scientific journals published on the Internet following the SciELO methodology. As English is the predominant internationally language both in scientific circles as in scientific publications, the SciELO's proposal allows the projection and the increase of the visibility of Brazilian scientific production, as well as of Latin America due the indexation of journals in Portuguese and Spanish.

The Objective of this research is to begin an exploration about public communication of science on the part of Brazilian science producing centers, mostly located in the graduate programs of public universities. Since the strict criteria of scientific communication are already consolidated among Brazilian researchers and scientists, it was established as a proposal of this research to investigate how these researchers and scientists respond to the demand of the Knowledge Society by a public communication of science and technology.

It was chosen the methodological approach of a survey with Graduate Programs in Public Health (GPPH) offered in Brazil and recognized by the Coordination of Improvement of Higher Education Personnel (CAPES), linked directly to the Ministry of Education of Brazil. During the National Forum of Coordinators of GPPH held in May, 2010 at the School of Public Health, University of São Paulo (SPH-USP), was applied to the coordinators a semi-structured questionnaire after that it was analyzed the answer to the question: For you what is public communication of science? Among 41 coordinators, 33 answered the questionnaire.

Three categories of conception of public communication of science and technology (PCST) were found: (1) PCST understood as communication among peers, (2) PCST understood as science communication as extending to the society without necessarily a treatment of language employed in the information transmission and (3) PCST understood as a communication expressed in public language representing at the same time a challenge and also an obligation to scientists and to researchers.

Preliminary conclusions of the analysis of the first stage of this research indicate that the PCST is part of a non-explicit agenda of GGPH that does not constitute at moment a communication policy of those programs. The questionnaire is part of a doctoral research in development at SPH-USP that was approved by the local Ethics Committee (Research Protocol No. 2072). A second stage of the doctoral project that study the PCST production in the GPPH will apply a supplementary questionnaire and interviews that will provide a detailed analysis about the PCST at GGPH recognized by CAPES.

Keywords: PSCT Conception, Graduate Programs in Public Health, Comunication

Constructive Study on Equilibrium Model of Science Communication–A case from China Science and Technology Museum

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Abstract. "Dominant model" and "Equilibrium model" were two different patterns in communication used to explain the relationship between mass communicators and receivers. "Dominant model" was prevalent in conventional science popularization, which was one way communication, from communicators to receivers with little feedback. "Equilibrium model" saw communication process was bidirectional—information was not only flow from communicators to receivers, but also the opposite direction. "Equilibrium model" was developed to meet today's communication value which promote "equality" and "interaction".

In China, science and technology museums was a large group, besides China Science and Technology Museum (CSTM), nearly each province has its own science and technology museum. They were featured as the primary force in mass science popularization and technology diffusion. However, for a long time, even today, most of the museums took "Dominant model" as their main communication method. Reflecting on the current situation, China Science and Technology Museum has explored "Equilibrium model" to upgrade its communication method, to construct a scientific community.

Main efforts included:

a. ***Interactive exhibition.*** In addition to increase participation in interactive exhibitions, CSTM took use of different channels and methods to balance the relationship between communicators and receivers. Before hold a new exhibition, CSTM do a large scale investigation to collect audience's ideas and demands, which give audience a way to express their science popularization needs, and also a guide exhibition design. During the exhibition, there will be several facilitators, they can have a face to face communication with audience. CSTM also use Radio Frequency Identification(RFID) to track audience, measure their preferences. And there is a timely evaluation after the exhibition.
b. ***Digital museum and network.*** China Digital Science and Technology Museum (CDSTM) took use of digital technology, put exhibition, education activities and science knowledge on the internet, people are easily to click and participate. There also was an internet forum, people can exchange ideas and make suggestions freely. With the help of internet, CSTM built a network with local museum and many international museum, which give users a much broader show.
c. ***Participatory science laboratory (PSL)*** is a platform for the public to participate the science research process. CSTM has built four PSL, each one will invite scientists to guide the public do the science research. The public can discuss with scientists, give suggestion to improve the experimental procedure and gain knowledge and information during the participatory process.
d. ***Scientists forum.*** From year 2010, CSTM invite famous scientists to give lecture in term of current hot science issues. The public can have a face to face discussion with these scientists and exchange ideas.

These are examples of efforts that CSTM has done to improve the effectiveness of science communication, which can be simply described in the following figure:

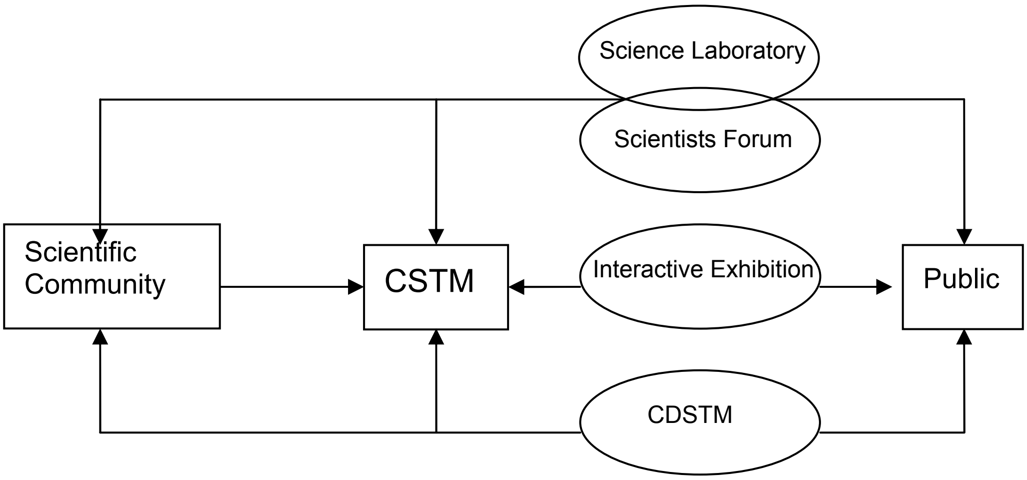

Figure 4：**"Equilibrium model" of CSTM**

Keywords: Science communication, Equilibrium model, Science and technology museum

Science Communication Through Radio

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Abstract. By Communication of information about science and technology is essential for social and economic development. The media is often assumed as an efficient and effective means of disseminating information about various fields including science. Science communication is the key to the scientific knowledge, by virtue of which scientific knowledge and concepts can be carried to the common people. Thus, the common people are benefited with the new advancements in science and technology, and are able to fight hunger, drought, disease, and social evils such as superstitions, with self-confidence, courage and faith. Science communicators usually communicate to non-scientific audience. Communicating science to the public comprises diverse approaches such as public talks, debates, exhibitions, publications, science theatre and television documentaries. Often, these activities form a part of a wider campaign to engage people in science. In recent years, the volumes of scientific information and news have grown rapidly, but the coverage in the media has not grown that exponentially. There is a need to analyze the coverage given to science news / information in Indian media with special emphasis on radio. Now that radio has got revival, it has gained speed of conveying information which no other medium has. The news broadcast on radio has a style and pattern of its own which is quite different from a report in the press. Radio can put across 'hot' news to create awareness, though awareness to action calls for an integrated approach to development. Of late, people are particularly interested in health and environment, and this has been reflected through increased coverage. The scope for specializing in environment communication and health communication is increasing. The radio of diverse nature–be it All India Radio, campus community radio, NGO community radio, and educational radio such as Gyan Vani makes efforts in imparting and understanding scientific temper. The paper looks into various possibilities of communicating science effectively through radio, particularly in terms of updating the people with the latest in science and technology. While, radio concentrates on broadcasting phone-in programmes, talk-shows, drama, discussions, symposiums, and debates on subjects of social interest, health, developmental activities and civic consciousness. The paper discusses the various modes of communication by the use of radio. Jayaprakash D. is a PhD Research in the Department of Media Sciences, Anna University Chennai, Tamil Nadu, India.

Keywords: Scientific temper, Scientoon, Campus community radio, NGO radio

Art and Science: A Powerful Partnership for Climate Change Communication

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Abstract. In its apocalyptic scale and emotionally charged urgency, climate change is like no other issue in science communication. Climate scientists hold knowledge about the fate of life on earth. And those who have studied the science in detail and written books must sometimes have been overwhelmed. For example, in writing 'the future of biodiversity and civilisation hangs on our actions' (Tim Flannery 2005), and 'there is almost no time left to act' (James Lovelock 2006), scientists are revealing the unbearable reality that lies in the unemotional graphs and statistics that are the tools of their trade.

Apart from the unacknowledged emotional burden the scientists bear for humanity, an honest emotional response to the significance of their assessments is rarely publicly discussed and hardly ever mentioned in communications from political and business circles. In relation to climate change, it is difficult to find examples of the axiom that communicators must 'talk with' rather than 'talk to' people about science, although this has been a well-accepted conclusion of the UK Government's report on *Science and Society,* and the White Paper on science innovation policy for the 21st century, which stated:

'... science is too important to be left only to scientists. … When science raises profound ethical and social issues, the whole of society needs to take part in the debate.'

The likelihood that artistic vehicles would help carry emotion and unblock the way towards emotionally mature, wise actions by policy makers has been explored in poetry, music and drama by the Canberra group A Chorus of Women in many presentations since 2007. These original presentations have drawn on the work of the Australian poet and environmentalist Judith Wright, Australian sculptor Tom Bass and the Greek playwright Aeschylus (480 BC).

This paper describes the philosophical, artistic and emotional underpinning of two of these presentations, and provides insights from the facilitated discussions between scientists and nonscientists that have followed the performances.

Indian Media Coverage of Climate Change: A Study

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Abstract. Global climate change may be the greatest environmental risk of our time, and of all time. It has the potential to affect all of the Earth's inhabitants, like previous climate change has, but perhaps in a shorter time-frame and on a larger scale. It could alter life as we know it in many arcane, unpredictable ways (Wilson, 1995). Reporting on climate change must address the deeper social and economic dimensions of sustainable development. Reporting needs to be multi-faceted, given the complexity of the issue. Climate change demands both political and personal responses, and this will depend on timely, accurate information. The fact that the reality of today is mediated mostly by the media means the media is the tool to make people informed citizens.

Journalists were more likely to exaggerate rather than reduce measurements. For example, journalists were more likely to exaggerate and not underestimate the rise of sea-levels. The emphasis on bad news, on the potential of horrific events happening, is more newsworthy than information discussing potential subtleties over a longer period. The theory is often used to demonstrate the power of the media over audiences. Agenda-setting studies have suggested that media coverage does influence public attention to climate change, but what to think with regard to the issue is determined by social activism and experience with ground reality.

The methodology of the study is: discourse analysis with the media text including those of The Hindu, The Times of India, The New Indian Express, Deccan Chronicle, NDTV and CNN-IBN; and interview with 25 journalists covering climate change and working in the abovementioned media organizations. The study also involved interviewing some environmental journalists in Chennai. Based on the interviews and review of literature, the following points were arrived at:

- Climate change is abstract, not connected with day-to-day reality;
- Climate change is too broad a topic;
- Climate change is mostly a technical matter;
- Journalists ignore climate change as part of news coverage as they do not understand the technicalities involved.
- Scientists do not give climate change literature in a jargon-free language;
- Journalists hardly receive in-service training on climate change;
- Journalists fail to link ground realities with existing policies and politics.

A discourse analysis of media text proves that journalists have been quite successful in communicating the enormity of the risk planet earth is facing due to climate change. The media makes it clear that problems faced are due to human causes rather than natural causes. The problems faced by climate change journalists are similar to those in other beats. Lack of sensational content may cause reports to get sidelined. So, controversies such as an error in assessing melting of glaciers in the Himalayas are blown up. The fact the Himalayan glaciers are a little explored area complicates the matter. It is difficult to find sources and one cannot get concrete facts. With extensive competition from other media organizations covering the same news story, the media has taken up to approach the story from different angles to retain the news hungry public. Lack of local scientific data and scientific measurement methods too poses a problem.

Medical Science Communication Emerging Challenges–A Study

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Background

The rapid transition in the medical and health sciences and technologies over the last 50 years towards a molecular understanding of human body in health and disease and the rise of a host of molecular and digital technologies for investigating and intervening with the body is still largely not available for practical application

The contemporary transition in medical and health science and technology towards molecularization, miniaturization, mediated visualization, digitalization and intangibilization is a major challenge. Current molecular biological research is very dependent upon visualisation methods, both in the production of interpreted data and in the communication to other scientists and the public at large. In this background an attempt is made to study the significance of medical communication on HIV/AIDS.

Methods

In a pilot research, 300 science degree students of different colleges studied about the level of understanding of medical science communication from Jan–2008 to Dec–2009. AIDS health education sessions / contact programmes were organised for different colleges in Andhra Pradesh in batches viz., Batch–A, Batch–B, Batch–C, Batch–D, Batch–E, Batch–F. Each Batch has 50 students

A pre-tested questionnaire was given to all participants before the session on HIV/AIDS–causes–prevention and treatment subsequently after the session a questionnaire is given to all those participants.

Results

The awareness of AIDS among Batch-A was 29%, Batch–B 13%, Batch–C 43%, Batch–D 39%, Batch–E 49%, Batch–F 56%, before participating in the AIDS health education session. Whereas the awareness has gone up to 59% among Batch–A, 39% in Batch–B, 81% in Batch–C, 69% in Batch–D, 63% in Batch–E and 89% in Batch–F after participating in the session. Using a Chi-squared Test, the impact of AIDS health education was found statistically significant among the studied college students viz., Batch–A, ($P<0.001$) Batch–B ($P<0.005$) Batch–C ($P<0.001$), Batch–D ($P<0.005$), Batch–E ($P<0.02$) and Batch–F ($P<0.005$).

Summary

Basing on the session, it is recommended to develop research-based science communication practices for a variety of audiences–spanning from health professionals to the general public–in the form of exhibitions and web products, and with special attention to the aesthetics of science communication. People interested in medical science communication are well advised to broaden their vision to other domains of science communication studies and practices. There is much to be learned from science communication studies dealing with a wide array of sciences through a variety of media.

When 400 senior European life scientists were asked which complementary skills they would have liked to receive training in earlier in their career, 37% and 33% mentioned public communication and peer-to-peer communication, whereas only 17% and 11% mentioned research ethics and bioethics: On analysis the answers given by the college students on medical science communication before attending the session and after attending the session, there is a significant improvement in understanding the various aspects of ‘HIV/AIDS’.

Science Communication in the Context of Scientific Literacy: A Case Study of Bangalore Science Forum, Bangalore

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Abstract. The present day society and human life is interwoven with scientific and technological advancements. We are living in the age of car, TV, internet, Wifi, 3G, MRI, IVF, Robotics, nanotechnology, MEMS and many more. All these gadgets, concepts have entered into our everyday life. In order to live in such a society and to lead a meaningful life, this kind of situation demands that we acquire a basic minimum of information and knowledge of the nature of science and technology in terms of what is called as Scientific Literacy. Such literacy while being complementary to overall literacy enables us to critically appreciate the interlinks between science, technology and society. Now one of the most of important means of acquiring such literacy is Science Communication. It is well recognized that Communication is the essence of science in all its aspects, be it technical or non-technical. In addition , it is important to recognize that to the extent that science is a public enterprise, the institutional dimensions of science communication are of great importance.

In the light of the significance attached to communication we intend to discuss the meaning, scope and necessity of science communication in context of Scientific Literacy. After presenting certain preliminary observations concerning the nature of science communication we will present a description of the activities of The Bangalore Science Forum with a view to indicate the institutional dimension of the process of science communication. Following this we will suggest ways in which institutional aspects can be combined with other aspects of communication network to make the spread of scientific literacy a comprehensive domain accessible to a wide audience.

Science Communication generally refers to person/media aiming to talk about science with non scientists and scientifically literates also. It is some times done by professional scientists but has evolved into a professional field in its own right. When science is communicated rightfully it should have purpose and impact on the community to whom it is addressed. The purpose is to obviously make the community scientifically literate and impart is felt if the community absorbs and interacts in society.

At this junction we would like to know about what is meant by Scientific Literacy? According to National Centre for Education Statistics, scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participating in civic and cultural affairs and economics productivity. It also includes specific types of abilities. A scientifically literate citizen should be able to evaluate the quality of scientific information on the basis of its source and methods used to generate it.

In the above context of scientific literacy with specific reference to India we would like to discuss the activities of Bangalore Science Forum with a view to indicate the institutional dimension of the process of communication. The Bangalore Science Forum was Established in 1962, it is about to complete its Golden Jubilee in two years. The Forum conducts, weekly lectures (about 2300 completed), summer school and lecture competitions for the past four decade consistently.

Recently this Forum is conducting science lecture competitions in vernacular for undergraduate students. It has conducted science model making for higher secondary students. This year the forum is conducting a Laser Fest in the month of October. Obviously for the selfless services rendered to society on a voluntary basis, the forum has been awarded two National Awards for Science Communication. In our Paper we will be analytically examining the activities of the forum. Finally, it is our argument that the scope and significance of scientific Communication is best understood in terms of relationship between the process, the institutional frame work and well motivated public participation.

Quantitative Indicator Design of Science Popularization Performance of Science Museums

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Abstract. There was no mature evaluation system to judge the science popularization achievement and effect of science museums in the mainland of China previously, especially no objective evaluation indicators. This article designs 10 quantitative evaluation indicators from the science popularization environment, science popularization achievement and social recognition of science museums. This set of indicators forms a practical evaluation system of science popularization performance of science museums. The system data are easy to get, the evaluation is objective, comparative and applicable.

Keywords: Science Museum, Science Popularization Function, Performance Evaluation, Quantitative Indicator System, Design

How to Communicate a Micro Propagation Technology?

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Abstract. Micro propagation industry is a profitable option. It suits India as it is labor intensive, environment friendly and promises to improve agri-horti and forestry sector productivities. Further, Agro climatic diversity in India, trained personnel, tissue culture research pool huge unexplored domestic markets, off shore markets because of price competitiveness on account of cheap labor make it a potential foreign exchange earner. The micro propagation industry in the country is under performing in this country primarily due to certain grey areas in communication between Research and Industry, financial considerations for technology sustainability, lack of popularization and reluctant acceptance of the Technology. There had been problems during executing transfers, such as variation in results from the claims in the hands of the industry and difficulties in setting up of the production processes based on the lab protocols provided by the institutes. The poor in-house R&D capacities in micro propagation industries in India necessitate complete description of technology including complete scientific data, information, know-how for the manufacture of the product and the component etc. Further, the process of commercialization should go through conceptualization, basic work, applied research, pilot demonstration and commercialization.

The present work reports how to communicate micro propagation technology successfully through proper communication. The case study was performed with a bamboo micro propagation technology developed by Arya *et al*. (1996). The technology was extended to micro propagation facility of Sheel Biotech Ltd. Gurgaon in three different ways and the performance of the production process was evaluated. One time technology transfer by providing published literature and starter cultures led to an effective shoot multiplication rate of 4 times, a rooting efficiency of 60%, a post rooting survival of 20% and poor growth of plantlets. Demonstration and a short training at technology developer's institution i.e. at FRI Dehradun besides providing published literature and starter cultures improved the overall protocol performance with an effective shoot multiplication rate of 5 times, a rooting efficiency of 72%, a post rooting survival of 68% and average growth of plantlets. Performing all the steps of micro propagation in the production set up where the technology is to be used led to most efficient performance of the technology with an effective shoot multiplication rate of 6 times, a rooting efficiency of 95%, a post rooting survival of 98% and excellent growth of plantlets.

The work concluded that several factors pertaining to species taken for micro propagation, the production staff and production set up influence the performance of a micro propagation protocol. Fine tuning protocol parameters at the end users place besides training of production personnel at the production set up is necessary for rapid and successful technology transfer process.

A Model Research on Public Channels for S&T Information in China

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Abstract. Channels and ways through which Chinese citizens obtain science and technology information are one important part of promoting Chinese civic scientific literacy level. They are also a very important part of the Chinese civic scientific literacy survey, which concludes public media channels, public utilization of science popularization facilities such as Science and Technology Museums and public engagement in science popularization activities. In this paper, a research on public channels on S&T was conducted based on previous surveys data. The objectives of this paper were to comb out the categories of public channels and the changes of utilizing proportion, to probe the relationship between public channels for S&T information and civic scientific literacy, and to sort out the characteristics and variation trends of public channels for S&T information among Chinese citizens. Through the analysis on the 8th civic scientific literacy survey data in 2010, models of public channels for S&T information in each provincial units in mainland China were obtained. Regional evaluation was carried out in different areas based on various characteristics of public channels for different groups of people. Regional division on Chinese civic scientific literacy was conducted according to those models. This has important practical significance for conducting Chinese civic scientific literacy construction work differentially.

Keywords: Information channels, Science popularization, Scientific literacy

Introduction

The investigation on pubic channels to get S&T information is a crucial part of the survey on Chinese pubic science literacy. For with the rapid development of Chinese economy and the increasingly improvement of education and science popularization in China today, the development of communication medias such as movie, television, newspaper, journal, book and internet are playing more and more vital roles on the knowledge enhancing and the science information getting in Chinese public. Meanwhile, the science popularization facilities such as S&T museum, arboretum and zoo, and science popularization activities and skill trainings held by national and local institutes become the ways for public to obtain S&T information as well. Furthermore, due to the influence of culture factors, the interpersonal communication also does some works to promote the circling of S&T information. Based on all previous surveys of public science literacy in China since 2005, this paper gives an analysis on the channels and ways for Chinese public to attain S&T information, in order to know how Chinese people obtain S&T information, understand the laws underlying it, and provide suggestions and grounds for Chinese government to make relevant policies.

Television and newspaper are the main channels for Chinese public to get S&T information

The survey results in 2010 show that television and newspaper are the main source of S&T information for Chinese public with the proportion being 87.5% and 59.1%. We can see from table 1 that the percent of respondents selecting television and newspaper as S&T information source are high in all these surveys.

Table 1 The source of S&T information for Chinese public (%)

	2005	2007	2010
1.Newspaper(N)	44.9	60.2	59.1
2.Book(B)	10.2	11.9	11.9
3.Radio(R)	22.4	20.6	24.6
4.Television(T)	91.0	90.2	87.5
5.Science journal(Sj)	9.5	13.2	10.5
6.Internet(I)	7.4	10.7	26.6
7.Personal communication(P)	48.7	34.7	43.0

The proportion of other channels remains stable except the considerable raise in internet. The percent of public naming electric media as the source of S&T information has been increasing (7.4% in 2005 and 26.6% in 2010). This is consistent with the trend of internet development in China. The rapid expansion of economic and social development in China widened the channels for Chinese citizens to get science & technology information. Moreover, it is important to note that, due to the undeveloped communication facility and traffic infrastructure in China, public in main districts depended largely on personal communication as the main source of S&T information. The data of 2010 showed that 43 percent of the public reported communication with relatives and colleagues as their S&T information source, being distinctly higher than 20.2 percent of 2001 and 28.5 percent of 2005. As to this phenomenon, we think that it is just the influence of culture factors and economy development that makes personal communication the main source for Chinese public to obtain S&T information.

The opportunities that Chinese public use science popularization facilities gradually raised

In 2010, the proportions of public who visited science popularization venues are 57.9% for zoos, aquarium and arboretum, 27.0% for S&T venues such as science and technology museum, 21.9% for museum of natural history. The proportions of respondents who visited cultural and art venues are 50.3% for public library and 26.4% for art gallery or exhibition museum. The proportions of public who visited sites for popular science are 54.5% for reading room, 48.7% for science popularization gallery or publicity column. The proportions of citizens who visited professional technology venues are 35.5% for science and technology demonstration site or science popularization activity station, 34.2% for industry and agriculture industrial park, and 11.2% for universities and research institutes laboratory. Comparing with the situation in 2005, the proportion of citizens who have visited sites for popular science saliently increased. The proportion of the reason ‘Not in local’ for not visiting those facilities for popular science decreased over the years. Take the situation of visiting science and technology venues as an example, the proportion of respondents who visited those venues is 27.0% in 2010, which raised 17.7% comparing with 9.3% for 2005. The proportion of public who didn't visit these venues because of 'not in local' is 37.6% in 2010, which decreased 18.1% comparing with 55.7% for 2005.

The proportion of public who participated in science popularization activities and training increased

The 2010 survey showed that the proportion of public who took part in large-scale mass science popularization activities such as science and technology week, science festival and science popularization day is 23.8%. The proportions of citizens who participated in all sorts of regular science popularization activities are 35.6% for science and technology training, 31.4% for science and technology consultation, 29.4% for popular science lectures, 25.1% for science and technology exhibition and 13.7% for science popularization campaign vehicle. Meanwhile, for science popularization campaign vehicle, though the proportion of participation is low, over 62.8% of respondents indicated that they've heard of it.

The Difference Among Different Groups of Public on S&T Information Getting (Based on 2010 Survey)

The difference between different genders of public on S&T information getting

There is little difference between male and female respondents on their channels of knowing the current affairs of which television is the leading source while personal communication and personal communication ranks the second and the third. Male respondents, however, report that they tend to get S&T information from newspaper, magazine and Internet, while female relies more on communication with relatives and friends.

Table2 Information source of respondents with Male and Female

%	N	B	T	I	P
Male	64.0	12.5	88.9	28.9	41.4
Female	56.5	11.8	89.8	25.3	46.5

Taking the situation of visiting science and technology venues as an example, the proportion of male citizens who visited these venues because of 'Self interests' is higher than that of female citizens, with the numbers being 11.1% and 7.5%. The proportion of female citizens who visited these venues 'With relatives' is higher than that of male citizens, with the numbers being 8.1% and 7.3%. From this we can see that male citizens intend to visit science and technology venues more initiatively.

The difference among people with different educational background on S&T information getting

Although television is the main source of S&T information for people with any level of education, the data show that the dependence on television tends to reduce with the increase of educational level: the highly educated people tend to get the S&T information through newspaper, book, magazine/journal, and internet, while the low educated people depend more on the media such as television, personal communication, and radio.

Among the public with low or none education, about 91.2 percent (2010) of the public reported getting S&T information through television, namely television was the main source of S&T information to them, while two continuous surveys showed that both percents of these respondents naming electric network as S&T information resource were low. Compared with other people with different level of education, this group of public intended rather to choose communication with relatives as their way to get S&T information, and the percent of respondents in this group who like to choose radio as information source was higher than that of other groups of respondents. Despite of low or none educated, part of these respondents maintained that they got the information by newspaper as the information source. Information source of respondents with different educational level (%) are shown in Table 3.

Table 3 Information source of respondents with different educational level (%)

	Level of Education	N	B	R	T	I	P
2010	1	17.2	7.9	36.4	91.2	3.7	68.1
	2	42.0	10.2	36.5	93.4	8.5	61.5
	3	63.8	11.9	27.0	91.5	19.0	47.5
	4	71.7	13.9	18.7	87.7	36.3	33.7
	5	73.9	13.6	12.9	12.9	61.9	20.6
	6	71.3	15.2	9.3	9.3	75.5	17.3
2005	1	4.8	4.1	24	84	0.8	59.8
	2	27.3	5.6	24	91.1	0.2	60.3
	3	53.4	11.4	23.2	93.6	4.6	47.4
	4	73.7	17.4	18.4	89.8	20.5	31.4
	5	76	17.1	14	87.9	42.9	20.3
	6	68.4	24.6	14.1	77	55.4	7.4

1=None or low educated; 2=Preliminary school; 3=Junior high school; 4=Senior high school/technical secondary school; 5=Junior college; 6=University and above

One important feature of the group with university and above level of education is that the percent of them naming internet as channel to get S&T information was the highest among all the groups, the number of which is 75.5 in 2010, which increased 10.1% than 2005, being much higher than that of other groups.

Several characters of the relationship between the main channels for China public to get S&T information and their educational level were revealed in these surveys: the percent of respondents naming modern technique as way to get information, including S&T information, was positively related to the educational level, and this trend was salient; the traditional channels such as television, radio personal communication was negatively related to the educational level; the percent of respondents naming book, newspaper and journal was positively related to the educational level.

The difference among different age of pubic on S&T information getting

Analysis of the difference among different age of public on S&T information getting showed that the percent of naming newspaper was the highest among respondents aged from 30 to39 and from 40 to 49 (over 50%). The highest percent of naming book fell on the youngest group, among which 16.7 percent of respondents reported relying on book to get knowledge and information, while the group from age 50 to 59 reported the lowest percent of naming book. The respondent naming radio as the most favor way of getting knowledge was from the age group of 60-69 and the percent of youth naming this way was the lowest. Young people remained the group who liked magazine/ journal most. The percent of public naming magazine/journal was negative related to age: the older the respondent the lower the percent was. Internet as information source was negative related to age: about 59.1 percent of young respondents accessed internet to get information, the percent of group aged from 30 to 39 who named internet was as low as 4, while only 9.4 percent of the respondents older than 60 used internet to get information. Moreover, the percent of respondents naming communication with relative or colleague deserves our attention: the number was high in each level of age group while the percent of group from age 50 to 59 and 60 to 69 were the highest.

Table 4 Information source of respondents with different age (%) (2010)

	18 ~ 29	30 ~ 39	40 ~ 49	50 ~ 59	60 ~ 69
N	56.3	63.6	63.9	60.6	53.6
B	16.7	12.0	11.5	9.3	9.9
R	19.4	22.3	24.6	30.9	33.0
T	86.0	88.7	90.4	92.0	90.7
I	49.7	34.0	21.5	12.1	8.2
p	33.9	40.3	45.7	50.8	54.7
Others	56.3	63.6	63.9	60.6	53.6

Relationship between age and S&T information source could be seen from the percent of different age groups on reporting the way to get S&T information: □ the using of modern technology as information source was negatively related to age: the older the respondents the lower the percent of naming radio, television and personal communication as information source; □ the information source of radio, television and personal communication was negatively related to age.

The difference between urban and rural public on S&T information getting

There were great differences between urban and rural public on their channels of obtaining S&T information. Television being the main source of information, rural public, however, relied more on television than urban citizens to get information (91.6% vs. 86.5%, 2010). Furthermore, the percent of rural public (50.9%) who took communication with relatives and colleagues as S&T information source was higher than that of urban public (34.7%), while the latter had obvious high dependence on newspaper, book, magazine/journal, and Internet. The difference on internet utilizing was especially sharp: the data of 2010 showed that the using rate of internet by rural public (18.0%) was distinctly lower than that of urban citizens (39.2%), and this gap was still great yet decreasing. The increasing degree of internet-using of urban public is higher than that of rural public.

The proportion of rural citizens who didn't visit science and technology venues because of 'Not in local' is 45.3% and that of urban citizens is 28.5%. The rural citizens who occupied most of China's population are lack of opportunities and ability to use modern and convenient methods to get science and technology knowledge and other kinds of information. This is the focus in the civic scientific literacy construction work in China for the future.

The Development Trend of S&T Information Getting

It could be seen from the development trend of S&T information getting of Chinese public that the channels and ways for Chinese public to obtain S&T information has been developing in consistent with the diversified development of Chinese media and other S&T communication methods. The 2010 survey showed that the percent of public using television to get S&T information remained high. Of the newspaper and journal, the percents of public who took them as knowledge source were maintained at about 60 during 10 years since 2000. The percent of public using electric network as information source was increased most quickly: the number of it was only 1.6 in 2001, being increased to 10.7 in 2007 and to 26.6 in 2010.

In 2010, The Twenty-sixth Statistic Report of Internet Development Situation in China issued by China National Network Information Center (CNNIC) showed that, till June, 2010, the total number of internet using citizens in China exceeded 400 million the first time, reaching 420 million and ranking second in the world only after America. The popularizing rate of internet rose to 31.8%. As a new way of information circling, Internet is gradually infiltrating the lives of Chinese people and becoming a more and more popular channel of S&T information communication. The development trend of channels for Chinese public to get S&T information (%) are shown in Fig. 1

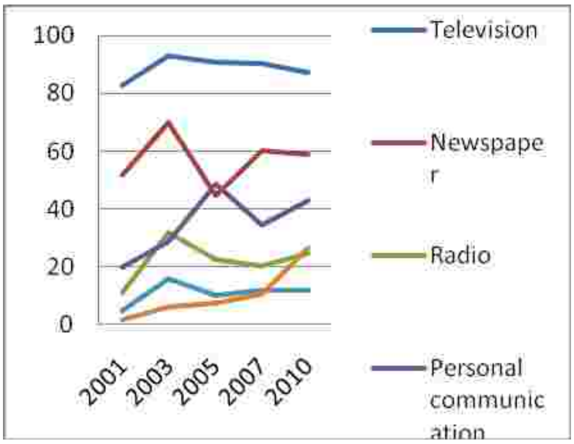

Fig 1. The trend of channels

Conclusion

Conclusion could be drawn from the analysis above that with the development of economy the channels for Chinese public to obtain S&T information become large diversified. Besides, the channels for different social groups to attain S&T information is affected deeply by the factors such as educational level and age: the lower the age and the higher the level of education, the wider the ways to get current affairs and S&T development information and the more frequent of relying on internet; the influence of internet, newspaper and magazine is great among the group with young age and high educational level.

To extend the channels and ways for public to obtain S&T information will have important influence on the improvement of science literacy of public, the high efficiency and effect of these channels could bring more opportunities for public to get S&T information actively or passively and then contribute to the improvement of nationwide public literacy, and the professional skill training will play crucial role in the future, for the percent of public who get knowledge about S&T through professional training is very high, especially in the rural areas.

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Making 'Science of Nutrition' 'Food for Thought' and 'Recipe for Development' of Masses through Resourceful Communication

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Abstract. Right nutrition of masses is both an index and outcome of development of a nation. Poverty, as per one of its most basic and poignant definitions, is lack of resources to acquire enough calories for daily nourishing requirements. Further, Nutrition as a science is contemplated as a growing body of systematically arranged facts about the consumption and utilization of food by the people. Nutrition, in an another context, as a process, is considered as the everyday fuelling or supplying the living body with the substances needed for its growth, maintenance and healthy physiological functioning.

Thus mandate for the science of Nutrition as a truly applied science that nurture nourishment, health and longevity could be realized if the basic facts of nutrition as a science are communicated, comprehended and put to use for bettering the nutritional status of individuals resulting in well nourished and healthy masses. However, this is no less arduous task, far easier said than done. For instance the decade old Food and Agricultural Organizations (FAO's) clarion call for '*Getting the Best from your Food'* communication wrested on making masses paying heed to their nutrition for staying healthy and fit.

However, the laudable initiative got stymied for want of effective delivery to the targeted masses in many countries including our own. Take another message, for re-emphasis on food safety which calls upon a robust two pronged action: (1) keep hot food hot and cold food cold, (2) When in doubt, throw the food out; has never met with the attention and importance it deserved for communication. Likewise, a message underscoring the role of nutrition in pregnancy and exclusive breast feeding in infancy makes out two causes for oft observed and invariably irreversible mental insufficiency of infants: (1) Mother's malnutrition during pregnancy, (2) Infant's malnutrition during first six months, have never been made to go down well with the masses. NFHS III (2005-06) figures of astronomically high maternal mortality and morbidity in India (MMR–254 vis-a- vis $\leq$ 10 of developing countries) and abysmally low percentage of exclusive breast feeding. (51% at 2-3 and 28% at 4-5 months of age) stare us straight in the face. Infact, there is a pressing need to beam the *exclusive breast feeding till 6 months* message to the mothers as well as other household members who often hold views different from this so as to create an enabling environment for change.

Suffice to say, the reason for the emergence of twin India in Indian polity; one poor and the other affluent, with both bearing the brunt of lopsided nutrition as deficiency or excess nourishment has been lack of imaginative communication strategies, awareness generating programs along with poverty alleviation endeavors. For, if a trend in lackadaisical communication of *Nutrition* science continues unabated, it could well become *Food for Heedlessness* and *Recipe for disaster*. Thus it is worthwhile to discuss Nutrition Communication in a bid to make effective, imaginative strategies for it.

All Sorts of Job Titles, But What Do You Actually Do? Profiles of Science Communication Professionals

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Abstract. Science communication (SC) professionals are employed in industry, government, businesses, NGOs, research institutes, media and museums. But it is difficult to compare their jobs because their job titles don't give a good indication of what they actually do: there are many different job titles for similar positions, and often professionals with the same title fulfill different tasks, whether or not on a different level.

Therefore, in this workshop we will focus on the tasks SC professionals carry out in their professional life. With science communication professionals from all over the world we would like to discuss and determine what kind of tasks they actually perform and at what specific level. In doing this we will make use of the model of SC professional profiles developed at Delft University of Technology. In addition we would also like to ask the SC professionals what kinds of knowledge and what skills they need to properly perform one of the specified tasks. Another interesting question concerns professional development: what kind of options does a SC professional have to grow?

This workshop provides professionals with a tool to position themselves relative to their colleagues and to reflect on their professional growth. For education developers, the outcomes of the workshop could provide a solid basis for developing refresher courses / post-graduate courses targeted specifically at the needs of the professionals.

Neuroscientists' Perceptions of Public Representations of Science: A Cross-national Comparison Between Germany and the United States

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Abstract. A topic that has been comparatively neglected in the science communication and science policy research literature is the question how media coverage of science and research can influence science governance processes. Previous research showed that researchers try to use the media to legitimize their research and attract research funding. However, it must be assumed that public expectations about research and especially the representation of such expectations in the media might have an influence on how research is regulated by the state or self-governed by scientific institutions.

Here we assume that scientists and researchers might react to public images of their research in two ways: First, by adapting their actual research practices to an image of research that is desired by the general public. Second is by choosing self-representations that live up to the expectations of the public. Hence, we are interested in examining 'informal' governance aspects of research through various media channels. We have chosen neuroscientific research as a case study. Research in the multidisciplinary field of the neurosciences is particularly interesting for studying governance processes since it is a field where various ethical, social, legal and economic issues and interests collide and, also, because various topics related to the neurosciences have generated a substantial amount of media coverage in the recent years.

In order to be able to investigate informal governance empirically it is important to first get an understanding of how neuroscientists themselves perceive the public image of research and also where they get their information from on science and society. To investigate this matter further we conducted a cross-national online survey in the USA and Germany. We assumed that media usage behavior differs between researchers in the USA and in Germany. 500 Neuroscience researchers from both countries, who had at least two publications in peer-reviewed journals in the field of the neurosciences, were sampled randomly. They were asked how they evaluate the impact of various information channels (e.g. print media, online news, TV and radio programs, blogs) on policy makers. It was also of interest how the neuroscientific researchers perceived the impact of media coverage of science on the general public. Furthermore, neuroscientists were asked about their own use of information channels. Another issue that was considered was the role of blogs and virtual social networks (e.g. facebook, LinkedIn) for the information strategies of neuroscience researchers.

The survey is in the field as the abstracts are reviewed, results are expected for late fall. The results will inform further steps in a comprehensive research project about informal governance aspects of research in Germany and the United States. These include the analysis of formal institutional ways of governing research in the neurosciences in the two countries; a cross-national comparison of media coverage of research in the neurosciences; and also focused interviews with senior neuroscience researchers in order to investigate how the neuroscientific community perceives its media image and the impact media coverage of their research field has on their research and working practices. Similarly, we also want to find out how neuroscientists assess the impact of media coverage of research on science policy makers and the general public.

Preaching to the Converted? An Analysis of the UK Public for Space Exploration

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Abstract. This article presents the results of a survey carried out at two space outreach events in the UK with the aim of characterizing the "public for space exploration". The survey involved 744 respondents who were asked through a self-administered questionnaire about their belief in extraterrestrial life, rationales for exploration, space policy preferences, attitudes towards space exploration and socio-demographic factors such as gender and age. The public for space exploration was mainly adults between 25-45 years old, and men were slightly more represented than women. The analysis of the relationships between the variables analysed showed that, despite general support for space exploration and particularly for human space missions among respondents, males appeared to be stronger supporters than females, i.e. males had a more positive attitude towards space exploration and stronger political preferences for higher government spending and more 'complex' means of exploration such as human space missions. Because mixed groups tend to come together to such events we argue that male respondents would be more likely to be part of the "attentive' interested" public who come to outreach activities and bring a less interested public with them. Outreach activities by more than mass mediated communication have the chance to engage a less attentive/interested public.

The Lack of Public Engagement With Nanotechnologies in Finland: The Deficit Model in Praxis

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Abstract. While preceding surveys have shown a high level of trust for science, technology and scientists among the Finnish populace, the recent Eurobarometer for Science and Technology has a different story to tell. Drawing on material gathered through a series of in-depth interviews with leading academics, public officials and other stakeholders involved with nanotech policy in Finland, this study aims to explore the attitudes towards the lack of public engagement with nanotechnologies, in the light of the aforementioned surveys.

The Eurobarometer survey suggests that Finns, though interested in new scientific discoveries and technological developments, consider scientists to foster a ‘tunnel vision’, concentrating on their individual fields rather than seeing their research in a wider perspective. The survey also shows that 47% of the respondents want the public to be consulted with regards to decision-making related to science and technology. A majority of the interviewees, on the other hand, show little understanding for the need for public engagement as the Finnish public, in their view, is very pro-technology, content with the situation, and generally disinterested in nanotechnology policy.

In conclusion, the paper suggests that the lack of public engagement in Finland is due to the institutionalized cultural circumstances in which Finnish nanotechnology policy and research and development is being carried out, which seem to suggest that Finland could be a textbook example of the deficit model in use.

A Proposal for an Intercultural Science Communication Model to Democratize Science

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Abstract. The present paper is part of an ongoing research project that seeks to establish the characteristics needed for the construction of new spaces to democratize science. Originally, we focused the study on 'science gardens', but very soon it became evident the need for the development of a science communication framework. Background literature review on preexisting science communication models indicates two main trends. One trend bases the model on political or ideological grounds, while the other one bases it on cognition patterns, which are common for all human beings. Although cognitive theories, borrowed from psychology or anthropology, are understood to be generally applicable to all humans, they can also be chosen in order to justify a specific ideology underneath a model. Particularly, when people are in the process of forming an opinion, research suggests that it can occur in the absence of relevant scientific or policy-related information (i.e. cognitive miser model). Also, in some instances, these models were only pertinent to the societies where they were first developed for, not general enough to be applicable to other cultural contexts. In order to consider Science Communication as a consolidated discipline, we need to develop general theories and models. We thus propose an 'intercultural science communication model', where culture is mostly understood as a language (symbols with a logical order) and science communication as a process between two ways of expressing knowledge: a technical language of science and an everyday language. In this way, a trans-cultural space is formed enabling researchers and diverse publics to engage in various conversations, exchanges, and interventions. This intercultural exchange is undoubtedly a participative process as it is dialogue among scientist, science communicators and society. Within this approach we refer to the so called dual model for cognitive processes, where two ways of learning and remembering are combined. Often, the two processes consist of an implicit (automatic), unconscious process and an explicit (controlled), conscious process. We will describe our proposed model and provide examples on its applicability.

Making 'Science of Nutrition' 'Food for Thought' and 'Recipe for Development' of Masses through Resourceful Communication

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Abstract. Right nutrition of masses is both an index and outcome of development of a nation. Poverty, as per one of its most basic and poignant definitions, is lack of resources to acquire enough calories for daily nourishing requirements. Further, Nutrition as a science is contemplated as a growing body of systematically arranged facts about the consumption and utilization of food by the people. Nutrition, in an another context, as a process, is considered as the everyday fuelling or supplying the living body with the substances needed for its growth, maintenance and healthy physiological functioning.

Thus mandate for the science of Nutrition as a truly applied science that nurture nourishment, health and longevity could be realized if the basic facts of nutrition as a science are communicated, comprehended and put to use for bettering the nutritional status of individuals resulting in well nourished and healthy masses. However, this is no less arduous task, far easier said than done. For instance the decade old 'Food and Agricultural Organization's (FAO's) clarion call' for '*Getting the Best from your Food'* communication wrested on making masses paying heed to their nutrition for staying healthy and fit.

However, the laudable initiative got stymied for want of effective delivery to the targeted masses in many countries including our own. Take another message, for re-emphasis on food safety which calls upon a robust two pronged action; 1– keep hot food hot and cold food cold, 2- When in doubt, throw the food out; has never met with the attention and importance it deserved for communication. Likewise, a message underscoring the role of nutrition in pregnancy and exclusive breast feeding in infancy makes out two causes for oft observed and invariably irreversible mental insufficiency of infants; (1) Mother's malnutrition during pregnancy, (2) Infant's malnutrition during first six months, have never been made to go down well with the masses. NFHS III (2005-06) figures of astronomically high maternal mortality and morbidity in India (MMR–254 vis-a- vis ≤ 10 of developing countries) and abysmally low percentage of exclusive breast feeding. (51% at 2-3 and 28% at 4-5 months of age) stare us straight in the face. Infact, there is a pressing need to beam the *exclusive breast feeding till 6 months* message to the mothers as well as other household members who often hold views different from this so as to create an enabling environment for change.

Suffice to say, the reason for the emergence of twin India in Indian polity; one poor and the other affluent, with both bearing the brunt of lopsided nutrition as deficiency or excess nourishment has been lack of imaginative communication strategies, awareness generating programs along with poverty alleviation endeavors. For, if a trend in lackadaisical communication of *Nutrition* science continues unabated, it could well become *Food for Heedlessness* and *Recipe for disaster*. *Thus it is worthwhile to discuss Nutrition Communication in a bid to make effective, imaginative strategies for it.*

Pioneering Science Communication Endeavours of Tamilnadu Science and Technology Centre

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Abstract. Science Centres are influential in providing education on modern science and new technologies. Tamilnadu science and Technology Centre works with a keen view to build an effective and democratic Indian Knowledge society, and with the aim to stimulate the harmonious integration of scientific and technological endeavour in the Indian social web. Mahatma Gandhi enumerates seven deadly sins. One of them is Science without Humanity. He says “If science becomes all technique and technology, it quickly degenerates into man against humanity. Technologies come from the paradigms of science. And if there's very little understanding of the higher human purposes that the technology is striving to serve, we become victims of our own technocracy. We see otherwise highly educated people climbing the scientific ladder of success, even though it's often missing the rung called humanity and leaning against the wrong wall. The majority of the scientists who ever lived or living today, and they have brought about a scientific and technological explosion in the world. But if all they do is superimpose technology on the same old problems, nothing basic changes .We may see an evolution, an occasional "revolution" in science, but without humanity we see precious little real human advancement. All the old inequities and injustices are still with us. About the only thing that hasn't evolved are these natural laws and principles - the true north on the compass. Science and technology have changed the face of most everything else. But the fundamental things still apply, as time goes by. “

Science matters to every single one of us. It affects our everyday lives in thousands of different ways, and the scientific advances of today will shape how our lives change in the future.

The popularization of science and technology is intended to provide broad sectors of the population with the challenge and satisfaction of understanding the universe in which we live and, above all, being able to imagine and build possible new worlds'.

Today there are societies that progress, build and create, and others that passively contemplate such progress, with little chance of understanding and adapting to the changes that progress implies. One of the major challenges facing developing countries is to make science and technology an essential part of the culture of the people.

At Tamilnadu Science and Technology Centre we realize the need for dissemination of Science and technology knowledge to uplift the society and also several unique methods are being adopted to reach different weak sections of the society.

Planetarium Show for the Hearing Impaired

India is a very populous country so the number of deaf people can not be definitely estimated. It is known to be in the millions. In children, hearing loss can lead to social isolation. Also the child experiences delayed social development that is in large part tied to delayed language acquisition. In order to bring cheers to the life of such children, and to provide education on astronomy, B. M. Birla Planetarium of Tamilnadu Science and Technology Centre, Chennai has developed a planetarium show exclusively for them.

During the past two years, Tamilnadu Science and Technology Centre organized a good number of ‘spend-a-day-in-science-centre’ programmes especially for the hearing impaired. In these programmes scientific facts were taught with the help of a sign language interpreter. Sign language is a language which uses manual communication, body language and lip patterns instead of sound to convey meaning. In this method by simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions the interpreter expresses the information. The programmes were successful as they were well received by the special audience. This success was an inspiration for us to develop a planetarium programme exclusively for the hearing impaired.

For this programme a simple script was developed and it was interpreted by a sign language interpreter. It was filmed and was projected using a LCD projector in a corner of the planetarium dome. After the presentation of each small paragraphs of the script, the appropriate animation or picture or constellation or celestial navigation or special effect presentation were shown. The following were the considerations for the development of this show.

1. Simple and straight-forward script; in normal scripts we use ornamental words; here the content is short and time is more–to enable them to view the pictures as well as interpreter's sign language

2. Application Oriented; Celestial Navigation, seasons, reason for seasons etc.

3. Illustration Rich; the pictures were provided with texts and pointers. Hearing-impaired children score significantly below norms for hearing children on language and reading measures. However, some of them who became hearing impaired at later stages can read text messages easily.

The first programme thus developed was given the title 'Sun and Planets' and was inaugurated in the morning of 12th June 2008 at B. M. Birla Planetarium Tamilnadu Science and Technology Centre, Chennai. To the programme children from several schools for the hearing impaired were invited. The students gathered were for at least three jam-packed shows at the sky-theatre. Some of the Special Schools have sections for vision impaired students. To the vision impaired students who attended this programme the script in Braille was circulated to enable them to know the content in advance.

After the inauguration, at least, once in a week a special show is being organized for the special children. The information about this noble task by the planetarium prompted several institutions to celebrate the Helen Keller Day on June 27th at the planetarium. On that day several shows from the early morning were arranged for the hearing Impaired.

Science Programmes for the Disabled

For the past five years Tamilnadu Science and Technology Centre is organising spend-a-day in science centre programme for the Hearing Impaired persons. A few sign language interpreters are being invited to accompany the students during the programmes. For the past two years, the Centre started organising such programmes periodically for the *dyslexia students, mentally retarded, physically challenged and visually impaired.* For the visually impaired, the planetarium programmes are being distributed in Braille language. Every gallery has a write-up in Braille explaining the content of the science gallery.

Programmes for Women

The development of our society largely depends on its capacity to create, exploit and disseminate knowledge and, from there, to continuously innovate. Scientific researches by men and women plays a major role in this regard, and should continue being one of the driving forces in promoting growth, welfare and sustainable development. The roles that men and women play in society are not biologically determined; they are socially determined. The roles of women are changing. These roles vary widely by locality and change over time. Science and technology have been an integral part of Indian civilization and culture. Women and men have been active in science from the inception of human civilization. However, due to deprivation of privacy and time to think, the percentage of Women Scientists in our country was very low. Presently, the trend is reversing and we find more women scientists now.

According to a study by United Nation's Population Fund (UNPF) about two thirds of the illiterate adults in the world are female. Higher levels of women's education are strongly associated with both lower infant mortality and lower fertility, as well as with higher levels of education and economic opportunity for their children. Education is one of the most important means of empowering women with the knowledge, skills and self-confidence necessary to participate fully in the development process. In fact, women require good training in ever advancing technological innovations. Realizing the significance of women's education in the fields of technology, Tamilnadu Science and Technology Centre is ceaselessly engaged in science communication activities exclusively meant for women empowerment.

Science Popularization

The popularization of science and technology is intended to provide broad sectors of the population with the challenge and satisfaction of understanding the universe in which we live and, above all, being able to imagine and build possible new worlds'. Today there are societies that progress, build and create, and others that passively contemplate such progress, with little chance of understanding and adapting to the changes that progress implies. One of the major challenges facing our nation is to make science and technology an essential part of the culture of men and women equally.

At Tamilnadu Science and Technology Centre we realize the need for dissemination of Science and technology knowledge to uplift the society and also several unique methods are being adopted to reach women and girl children.

Special Programmes for the Self Help Group (SHG) women

In the state of Tamilnadu Women Self Help groups are very active and are helpful to the society in many ways. SHG is group of rural poor women who have volunteered to organise themselves into a group for eradication of poverty of the members. The members of the group use this common fund and such other funds that they may receive as a group through a common management. The financial condition of the individual members safely improves generally with that of the group. Further, being a member gives them a secure feeling and enables them to gain knowledge, education and wider outlook. Tamilnadu Science and Technology Centre organize exclusive programmes to them in order to train them in various skills. To communicate the modern technologies to augment the skills of women SHGs, Computer training Programmes, Training on Vermi-composting, farming techniques to enhance the productivity, lectures on health and hygiene are being organized. SHG is group of rural poor women who have volunteered to organise themselves into a group for eradication of poverty of the members. The members of the group use this common fund and such other funds that they may receive as a group through a common management. The financial condition of the individual members safely improves generally with that of the group. Further, being a member gives them a secure feeling and enables them to gain knowledge, education and wider outlook. There are over 21,000 SHG in Tamilnadu. The training provided at Tamilnadu Science and Technology Centre helps them to enhance their income and also help them to lead healthier lifestyle. Similar Programmes are also being organised at Tamilnadu Science and Technology Centre for the homemakers periodically, which enables them to earn extra income for the family and have healthier life. Professionals from various research institutions like M S Swaminathan Research Foundation (MSSRF), IIT-Madras, CPR Environmental Foundation, etc and Experts from leading farms used to interact with the participants.

Programmes for the Home Makers

The development of the country depends on the attitude and the activities of the women who look after the needs of the every member of the family. Children spend long times intimately with the mother in the home. If the mother is empowered with scientific awareness then the children also will have brighter knowledge. According to Psychological studies environment plays an important role. Tamilnadu Science and Technology Centre organizes Programmes for the Homemakers periodically. By way of doing so, they are being provided with methods of earning money also. The waste management methods, producing bio-compost, vermiculture, home gardening etc are also being taught.

Programmes for the family-groups

The knowledge development of a child will normally be closely monitored by their relatives. The parents and grand parents know the behaviour and the knowledge level of the child in the residence. However, their performance in a group and in their school and the comparison with their peer groups will largely be unknown to them. The family science learning programme gives the family an opportunity to understand the standard of the children and enables them to effect ways to improve. Whole-day programmes are being devised with combination of subjects and Psychological evaluation of the students by a professional Psychologist.

Programmes for the Self-Help Groups and Village Heads

In the state of Tamilnadu Women Self Help groups are very active and are helpful to the society in many ways. Tamilnadu Science and Technology Centre organises exclusive programmes to them in order to train them in various skills. In addition, the village heads are important channels to transfer the government grants and the important announcements and the messages intended for the farming community. While organising the programmes for the Village heads we have seen the enthusiasm and the motivation among them to help the people of their region. Professionals from various research institutions like MS Swaminathan Research Foundation (MSSRF), IIT-Madras, CPR Environmental Foundation, etc and Experts from leading farms used to interact with the participants.

Programmes for the Students in the Rural Parts of the State

Outreach Programmes

In order to disseminate the information of Science and Technology among the general public and students community in particular, the Tamilnadu Science and Technology Centre has been extending good educational services through conducting various year round extension activities besides the permanent educational facilities like Planetarium, Halls of Science and Science Parks, established at Chennai and Tiruchirappalli. The following activities are conducted periodically, every year for the past several years.

Science Demonstration Lectures

Every week, on Saturdays, Science Demonstrations are conducted to supplement formal science education in Schools / Polytechnics. A good number of students attend this programme, in which using low cost innovative teaching aids science concepts are taught. The gadgets like nail bed, Liquid Nitrogen experiments, experiments on electricity, magnetism, sound, etc were developed and are being demonstrated free of cost.

Science Fairs

Science Fairs for the school students are conducted at least twice a year to stimulate ingenuity and encourage experimentation towards purposeful innovations. In this science competitions are also involved. These programmes are organised at various parts of the state.

Science Seminars

Seminars are conducted periodically for the School / Polytechnic / College students on the subjects of current interest.

Teacher Training Programmes to Focus on Science Activities

This programme is conducted mainly to train and motivate the teachers for the stimulation of science activities among students.

Under this programme schools from all over Tamilnadu are invited and guidance and work facilities are provided to induce scientific inquiry leading to experimentation and innovations to direct the abilities of students towards materialization of their ingenuity.

Film Shows

Educational Films are screened on different areas of Science, Technology and Culture as regular features.

Health and Family Welfare Exhibition:

As a part of Women's Education Policy, these exhibitions find immense use particularly to the rural sector.

Meet the Scientist Programmes

This is a very popular programme among the students of this region. Scientists and Technologists are invited to share their knowledge in view to improve the focus and the attitude of the school children towards education, science and technology. Yearly, at least, 40 Meet the Scientist programmes are conducted at Periyar Science and Technology Centre, Chennai and Anna Science Centre, Tiruchirappalli.

Meet the Medical Expert Programmes

To enable the student community to learn about the recent developments in the Medical field and also to motivate them leading Medical Experts are invited every moth on last Friday to interact with the students on various topics, such as, diabetology, E.N.T., Opthalmology, Cardialogy, Urology, etc., The experts perform basic medical scanning to the interested participants on-the-spot.

Mobile Science Exhibition

To popularise science and technology themes to the general public, especially for the school children in the rural areas of Tamilnadu, the Mobile Science Exhibition with 24 built-in participatory type of exhibits, based on the various themes of science such as sound and hearing, sensation, perception, vision and illusions, has been in continuous operation since January 1990. Mini-Planetarium programmes are also conducted along with Mobile Science Exhibition wherever facilities are made available. Science Video Programmes are regularly screened in the evening hours during the programme periods. Over 16 lakh persons have participated in the Mobile Science Exhibition programmes. During vacations, the Mobile Science Exhibition is conducted at the places of public gatherings like Arignar Anna

Zoological Park, Vandaloor, Government Museum, Egmore etc.

Setting up of Science Parks

In order to give impetus to the process of popularisation of science and technology among the students community and general public in the rural areas, the Periyar Science and Technology Centre has taken up the task of setting up of Science Parks in schools and in the different district headquarters.

Topical Programmes

Appropriate Scientific programmes are being chalked out to disseminate information to the student community and to the general public during special periods such as the Year of Scientific Awareness, International Year of the Earth, International Year of Astronomy, etc.

Temporary Science Exhibitions

The Centre participates in the All India Tourist and Industrial Trade Fair, being organised by the Tamilnadu Tourism Development Corporation at Island Grounds, every year and conducts the Science Exhibition displaying 50 exhibits in a separate pavilion of area 60' x 40'.

Science Programmes with Foreign Scientists

In coordination with the British Council, Chennai, Periyar Science and Technology Centre is organising lecture programmes by UK scientists and Science Fairs for School students every year.

In coordination with Alliance Francaise, Chennai, Periyar Science and Technology Centre is organising French Science Today programmes in which Scientists of various fields from France visit our Centre to deliver lectures on French Science Activities and new developments to the students.

Every year on the Cosmonautics day and on Valentina Tereskova's Birth Anniversary, special programmes such as quiz competitions, lectures and temporary picture exhibitions are arranged at Periyar Science and Technology Centre in collaboration with the Russian Cultural Centre, Chennai.

With the U.S. Consulate, Chennai the Centre conducts Science Lectures by NASA Scientists and Scientists from various other fields. Lecture by Mars Exploration Rover Mission Scientists, was conducted recently in coordination with them.

With IDP-Australia, Chennai, teacher training programmes are organised periodically, in which teachers are taught about creating simple gadgets to demonstrate science concepts to the students.

Science Popularization Through Mass Media

Our country has people with deep rooted unscientific faiths on celestial events. The generations to come should be relieved from the clutches of such unreasonable thoughts. Bearing this in mind Tamilnadu Science and Technology Centre is constantly engaged in spreading the information on celestial events, topical issues and general information through mass media. Activities aimed at the popularization of science and technology point in various directions, from the distribution of information in the mass media to formal education. A programme concerned with popularizing science and technology through mass media is easier to achieve than educational reforms, and could certainly lead more efficiently and rapidly to a more positive social attitude towards science and technology.

Conclusion

A number of historical, cultural, political, social and economic situations have given rise to the need to develop strategies that favour the popularization of science and technology in developing countries. The popularization of science and technology must make such knowledge a central component of culture, of social awareness and of collective intelligence. It must also contribute to an effective integration of cultural, ethnic, linguistic, social and economic issues. The technical possibilities of gaining access to information are changing our vision of the world and transforming the relationship between human beings and the appropriation and dissemination of knowledge. Today, access to knowledge is synonymous with development, well-being and quality of life; in this context, scientific and technological literacy is a social and ethical right of all human beings. Tamilnadu Science and Technology Centre is incessantly engaged in activities to empower the society with scientific knowledge.

Science Communication Education in North East India

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Abstract. More than half of the Indian population stays in rural areas and therefore connecting the unconnected becomes one of the primary challenges. Science and technology development and the general people's awareness are necessary for overall society development. No one can doubt the immense impact of science and technology on society today. We face the challenges of not only understanding the current multiple revolutions in science and technology, but also how they affect the future of humanity and of the Earth. So scientific information, scientific thoughts and spirit of scientific temper need to be spread across the society. Science communication can be referred to the flow of scientific information and message from its source to target audience, through some medium or mediator. Except a few very honourable exceptions, generally, scientists and technologists find it difficult to communicate with common man in common man's language. At the same time, the common man too is unable to understand the language of scientists - technical texts with technical jargon, specific to the subject area. Now, the problem is obvious, as the two are unable to communicate with each other which leaves a wide gap between the two and which is growing day by day due to rapid advancements in our scientific knowledge. The task is really very challenging and it needs proper training and education in the field of science communication.

This paper attempts the contemporary status of science communication education in NE as well as it emphasizes the analysis of relevancy of the course curriculum in modern context. The research work highlights the various constrains and challenges ahead in this regard.

Keywords: Science communication, Education, India's North East

Introduction

Dissemination of the proper scientific information among the general masses is the need of the hour. It requires proper training and education in science communication process to create the ability to understand, digest and assimilate the complex scientific information and to present it in a simple, lucid and interesting manner to the masses in the language, comprehensible to them. Indeed we need science communication training and education. The science communication education in North East India is still in very much juvenile stage. The mass communication departments of different universities and colleges have started special papers on science communication or science journalism as specialization. Let us start this discussion with a comprehensive history of mass communication education in the region—

Mass Communication Education in India's North-East

Journalism and mass communication education was started in the state in 1960's. Though a few organizations started correspondence courses in journalism, yet at that time it was not recognized as an academic discipline. Gauhati University started the first journalism course in the state through conventional education system. The Department of Communication and Journalism of the university came into existence in 1967. Being one of the first ten university departments of journalism studies in the country it was started as a part of the Political Science Dept. under the able leadership of Professor K Venkatarao who was instrumental in setting it up. At first the department offered an evening diploma course which was later upgraded to a bachelor degree level course named 'Bachelor of Communication and Journalism' in 1994. In the year 1983, the department became a full-fledged department with an intake capacity of 25 students. The department started Master degree course named 'Master of Arts in Mass Communication' in 2005. This is a full-time four-semester two-year programme with a total of 16 papers with several options for specialization.

The department facilitates the students of masters level with a library, one computer-cum-multipurpose laboratory classroom, digital still and video cameras including handycams and PD-170, LCD projector with screen, an 11 KVA power back up system etc. The department also organized four Refresher Courses (Multidisciplinary) in Mass Communication since 2006–07 at the UGC-Academic Staff College of GU with sufficient number of participants. The department has five faculty members and a good number of guest faculties. Among them two are permanent lecturers, one is a senior lecturer under science communication project and the other two are lecturers on contractual basis.

Though the department of communication and Journalism of Gauhati University was established in 1967, but the department of Mass Communication of Assam University, Silchar started the first master degree level course in the state. This department started functioning in 1996 and since then it has been providing quality training and media education at postgraduate and doctoral levels. Prof. Partha Chatterjee, a renowned media educator of Kolkata took the initiative as the Professor and Head to upgrade the department with an excellence. The infrastructure of the department consists of a Video Studio, Audio Studio, Associated Control Rooms, and a comprehensive post production facility with audio edit suites, FCP non-linear editing, Computer Lab and screening hall. The department's TV studio is fully equipped with broadcast quality equipment coupled with online multi camera production facility. Adding yet another feather to its illustrious cap, the department has been recently granted a Major Research Project (MRP) by UGC, New Delhi on the thrust area of modern mass India.

The department has been offering four academic programmes, namely Master of Mass Communication (Four Semesters), M.Phil (three semesters), Ph.D. and D.Litt of the total seven faculties serving in the department one is Professor, one Associate Professor and the rest are Assistant Professors. Prof. K V Nagraj is working as the Head of the Department.

Established in 2001, the department of mass communication and journalism at the Tezpur Central University is one of its kind in the entire northeast to have state-of-the-art facilities with provisions for production of industry grade quality media content. The department offers a two-year (four semesters) Master's programme in Mass Communication & Journalism with an intake of 26 students. The curriculum combines theoretical studies of media with practical and skill orientation, which includes courses in Television Journalism and Production, Visual Communication, New Media Technology, Film Studies, Advertising and Public Relations, Development Communication, Communication Research Methods and Applications etc. The department also offers a Part-time Post Graduate Diploma in Community Communication from 2009.

The department facilitates the students with an exclusive computer laboratory, an audio visual studio with a fully equipped audio/video studio with digital non-linear and linear edit solutions, multi-camera set-up make learning a unique experience. The Department has two DSR digital cameras for high quality productions and three PD-150 digital cameras for ENG exercises. The post-production facility includes Apple Power Mac with the latest version of Final Cut Pro, Apple G4 with the Media 100 edit suit, professional audio production facility includes protol software with the sophisticated digital audio production units. Presently, Dr Abhijit Bora is heading the department.

Media and Communication Study Centre was started by the Entrepreneurship Development Cell in 2004 at Cotton College, Guwahati with the initiative of the Chief Coordinator and other members of the Entrepreneurship Development Cell (EDC) of the college and Dr Ankuran Dutta as its founder course coordinator. EDC was a five year project funded by the Department of Science & Technology and it was started in 2003. The media centre under the EDC initially started initially a 9 month course consisting of three level on mass communication in January 2005. Later the course became a self-financing PG Diploma programme. In 2008, the centre was renamed as Centre for Mass Communication & Journalism.

In the other seven states of the North East, Mass Communication education is comparatively new in their conventional higher education infrastructure. The Department of Mass Media, St. Anthony's College, Shillong is one of the pioneer in the field of mass communication education in the north eastern region. The Media department of the college has two separate graduate programs running. Mass Communication and Video Production were started on 14th of September, 1995 and the programme on Media Technologies was established on 13th of June 2001. St. Anthony's College started the undergraduate course in Mass Communication and Video Production in 1995, the first of its kind in the country, which has a national recognition for excellence and facility. It was in recognition to the pioneering effort of the college that the UGC sanctioned a second professional graduate course in Media Technologies in 2001. The two courses enable students to find their place among a burgeoning class of media professionals, not merely as multi-skilled technicians, but as individuals with a sound theoretical understanding of the larger social context within which the media industry functions. The department has surely prepared competent professionals in the fields of communication and journalism by instilling also a right sense of intellectual probing and responsibility.

In addition to this remarkable effort, Rajib Gandhi University of Arunachal Pradesh, Manipur University, Tripura University, Nagaland University, Mizoram University, Sikkim University and North Eastern Hills University have opened mass communication departments during past decade. The Department of Journalism and Mass Communication of Tripura University as established in 2009 at their main campus of Agartala. Mizoram University has started this department in 2010. The department in Manipur University was established in 2005.

In order to extend the benefits of the study of mass communication to any student interested in the field, the IDOL of Gauhati University started a PG Diploma programme in Journalism and Mass Communication and a two-year Master of Communication and Journalism (MCJ) programme from 2005 and 2008 respectively in open and distance learning system. MCJ is a modular yearly course. Under this scheme, a student successfully completing the first year will be awarded the PG Diploma in Journalism and Mass Communication and will be eligible for admission to the Final Year of the course. If they also successfully complete the Final Year module also, they will be awarded the MCJ degree.

The Directorate of Distance Education, Dibrugarh University also started a PGDJMC programme from 2007 for the distance learners of the state. In the next year, the university established a centre namely Centre for Studies in Journalism & Mass Communication and launched a regular P G Diploma course in conventional mode. Professor Kamala Borgohain is the Director in-charge of this centre. Earlier, the university established a Media Studies Centre in collaboration with the Vikalpa Trust of New Delhi and started two programmes, namely Animation & Digital Film Making and Digital Film Making & Recording Arts.

Meanwhile, Krishna Kanta Handique State Open University was established and its academic works started functioning from the mid of 2007. This first and only state open university of the north east launched a Bachelor of Mass Communication Programme for the first time in the region. After receiving a good response in the BMC programme, the University has started two UG level diploma programmes namely Diploma in Journalism & Mass Communication and Diploma in Assamese Journalism and two PG diploma programmes–PG Diploma in Mass Communication and PG Diploma in Broadcast Journalism. The university has also launched Master of Mass Communication from the academic year of 2010.

Science Communication Education in India's North East

In 2005, the National Children Science Congress was organized in Guwahati. The Congress was fully covered by the students of the Media and Communication Study Centre of Cotton College. During the NSCC, the then course coordinator met Dr. Dinesh Ch. Goswami, eminent science communicator and scientist of Regional Research Laboratory, Jorhat. In a meeting, Dr. Goswami advised on the funding provisions of the National Council for Science and Technology Communication, New Delhi for the mass communication centres. Then the course coordinator immediately took the initiative and contacted to the NCSTC for funding. At that time, science communication was a new concept among the faculties of Cotton College. The new course coordinator Ms. Anamika Ray took initiative to start a special paper in science communication. Then she participated in a workshop on curriculum development of science communication at Jaipur organized by the Department of Mass Communication of Rajasthan University in collaboration with NCSTC, Government of India. After receiving the technical knowledge on the running of a science communication paper in PG Diploma course, the course coordinator of MCSC prepared a project with the help of the authorities of EDC, Cotton College, especially Dr. S K Choudhury & Mr. S K Nath. The project was sanctioned by the NCSTC, Government of India to run a special paper in science communication in May, 2007. After receiving the financial grant from the NCSTC, the Media Centre of Cotton College incorporated a special paper on science communication in second semester of the existing PG Diploma programme. Dr. Manoj Kr. Patairiya, the Director of NCSTC took special care to start the project for the first time in the region. Inevitably, it must be mentioned here that, some science organizations of the state organized so many workshops and seminars on science communication or science journalism, but for the first time it has been incorporated in an academic discipline in the region.

On the other hand, with the support and help of Dr. Abhijit Bora, then Lecturer and Head of Department of Communication and Journalism, Gauhati University, a lecturer of the department Dr. Ankuran Dutta prepared a different project to start science communication special paper in the Master of Arts in Mass Communication course of the university. This project was also sanctioned by the NCSTC, Government of India in 2008, but the coordinator of the project Dr. Dutta has resigned from the department and joined the newly established K K Handiqui State Open University, Guwahati. Science Communication is running as an optional specialization in the third semester of MA Mass Communication course of Gauhati University. Assam University, Silchar has also started an optional specialization in science and technology communication in the final semester of masters programme from 2009.

With an objective to start different courses in science communication and to pursue research in the field, K K Handiqui State Open University has planned to establish a centre. The university is offering a compulsory course in the third semester of bachelor degree programme and an optional course in the masters programme. But still the other universities have not incorporated science communication as a special course in their syllabi. In the syllabi of the maximum universities of the north eastern region, there is a provision of a small unit or a part of a unit on science reporting or beat reporting on science, but there is no separate course on it.

Course Content

After examining the syllabi of Gauhati University, Cotton College, K K Handiqui State Open University and Assam University, the researchers have found a few important topics of science communication that have been incorporated. The following are some common topics included in the syllabi:

- Definition of Science Communication
- Importance of Science Communication
- Need of Science Communication
- Concept of Science Popularization
- Various formats of Science Popularization
- Science through Traditional Folk Media
- Health Communication
- Environmental Communication
- Concept of Scientific Advertising
- Preparing for Scientific Advertising
- Laws related to Science
- Writing of Science News
- Writing of Feature and Articles on Science
- Sources of Scientific Information
- Various formats of Radio Programmes
- Various formats of TV Programmes
- Writing for Radio and TV on Science

Academic Seminars/ Conferences in Science Communication in North East

Considered as an academic activity, Seminars and Conference have been organized by different initiatives on science communication as an academic discipline. MCSC, Cotton College organized a workshop in August 2007 and after that in April 2009, Department of Communication and Journalism, Gauhati University organized a seminar.

The 9th Indian Science Communication Congress was organized for the first time in the entire northeastern region of India in K K Handique State Open University. The main aim of the ISCC 2009 was to focus on the meeting point of science and common man through communication which will be for the benefit of the society. The Congress was organized by National Council for Science & Technology

Communication (NCSTC) under Ministry of Science and Technology, Govt. of India and Krishna Kanta State Open University, Guwahati, Assam in collaboration with Indian Science Writer's Association (ISWA), New Delhi. The NCSTC, Govt. of India, has been organizing ISCC since the last eight years. The ISCC started from the year 2001. The meet has been organized in several cities, like Lucknow, Ranchi, Visakhapatnam, Gwalior, Varanasi, Ahmedabad, New Delhi and Chennai. The 9th Congress was organized at Guwahati.

The 9th Indian Science Communication Congress focusing on the theme "Science meets Communication" began on 20th December, 2009 with an introductory evening session on popular talks on Science Communication and formally came to an end with field visit for the participants on 24th December 2009. Around 180 delegates and participants attended the congress from all over the country.

Challenges and Recommendations

The researchers are actively involved in the science communication education in the north east. Therefore from the experience of the last five-six years, the researchers have realized the following challenges and would like to give some recommendations:

Lack of awareness/ importance on science communication education in North East

a. The mass communication discipline itself is comparatively new in the north eastern region. Except Gauhati University, all other universities have started mass communication courses in the last decade. So, importance on science communication is less among the institutions, who offer mass communication courses.
b. Lack of awareness is also another barrier. The concept of science communication is a new one and it is some time difficult to make the decision makers understood about the importance of science communication in the course of mass communication.

Negligibility of science communication in the syllabi of mass communication

We have gone through the various syllabi of different educational institutes, but found that the science communication is in a negligible position in the mass communication syllabi. Science reporting is only a small topic mentioned in the syllabi of different university's courses.

So, it may be recommended that science communication should compulsorily cover in the syllabi of mass communication courses and it must be incorporate as an optional course in masters level programmes. For example, without any financial assistance from the NCSTC or any other agency, K K Handiqui State Open University has introduced a full course of 100 marks on science communication in the third year of bachelor of mass communication programme as a compulsory course, not optional. The university has also included a full course of science communication in the final semester of masters degree programme.

Inadequate Financial Assistance to the mass communication universities

NCSTC is the nodal agency and the principal funding agency to run science communication course/ paper in the mass communication programmes. But, the NCSTC has given financial assistance only to Cotton College and Gauhati University.

They should encourage the other university to start science communication courses/ papers and the funding policies should be flexible.

Lack of proper infrastructure in the departments

It is noticed that the situation of the state universities or state funded institutions is very poor in contrast to the central govt. funded institutions and central universities. So, to improve the infrastructure of the department and to run a science communication course utilizing modern equipment and technology, the govt. should give a special fund to the institutes.

Lack of proper course materials of science communication

Science communication is a new area of study in the north eastern part of the country and course material on the discipline is very limited in the libraries. Text books are not available in the market. Therefore, the universities and the NCSTC may prepare some standard text books for this area of study.

Lack of experienced and trained resource persons

Another important challenge is the lack of proper trained and experienced person in the field. Therefore, NCSTC may organize some academic programmes like refresher course on science communication for the media educators.

Lack of model syllabus

A model syllabus should be prepared for different programmes. It is required to maintain the standard of the science communication programmes in different universities.

Lack of interest among the students

In the media of the north eastern state, science communication or a page/ space on science is not much popular. Therefore, the scope of the science communicator is less than other allied profession. In this connection, the institutions of national importance and the govt. should encourage the media to cover science stories as much as possible.

For society development it is very much necessary that common people should understand the science in right manner. This is the reason, science communication is required. But proper communication especially on science is very delicate and tough job which need proper education and training. With the help of Government and the transformation in common perception & attitude can change the scenario. And then only science communication can sustain in our society.

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e-VALIDATE: A Case Study on Building Remote Triggered Laboratories

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Abstract. Teaching science transcending barriers of society, national borders, and as right to education is a major uphill task that mankind faces today. Satellite and internet as a means of mass communication have shrunk the world today, making knowledge accessible to every doorstep. While video conferencing has effectively flung open the classrooms, a similar mass media technology that delivers a hands-on laboratory experience over the internet is still a major challenge. Laboratory experiments not only corroborate mathematical models used to describe nature they also highlight the inherent limitations of these models. Experiments and practical projects are indispensable tools that provide the framework for a learner to cope with real-world problems and gain hands-on experience. However, in last decade an increased private initiative in education has come with decline in the number of instructional laboratories replaced in most cases by an increased use of simulations which frequently replace physical experiments. Generally speaking, these simulator programs based on mathematical models are excellent tools for analysis and design only if the limits of the embedded models are known and the learner can cope with the abstraction level they represent. As mankind penetrates deeper and deeper into the mysteries of nature the number of physical experiments in education should have seen an increase instead of decline.

Advances in digital technology ensure most scientific instruments today can be made computer controlled without needing a physical access. With internet stitching computers into a World Wide Web, new possibilities come into being that promise to open up university laboratories to all those who aspire to study science and technology. Realizing this Ministry of Human Resource & Development (MHRD) has initiated through its National Mission on Education through Information and Communication Technology (NMEICT) a nationally coordinated pilot project on building Virtual labs that will facilitate elite educational and research institutions in India to open up their lab resources 24x7 beyond their campuses.

As a part of this national endeavor the Dayalbagh Educational Institute, has indigenously developed a **V**irtual **A**dvanced **L**aboratory for **I**nteractive **D**esign, **A**nalyze & **T**est in **E**lectronics (eVALIDATE) that exploits current internet technology to convert a traditional electronics laboratory for open access (http://evalidate.freehostia.com). Innovative architecture of eVALIDATE exploits latest Ethernet based LAN eXtension for Instrumentation (LXI) interface along with a unique GUI that provides a near real life laboratory experience that is as genuine as possible despite only a remote access to the real lab hardware. This is a first of its kind laboratory in India and one of its own kinds on the international scenario. The aim of this paper is to showcase this enabling technology which has potential to empower teachers' in bringing real laboratory experience into a classroom that is perhaps as small as the whole world.

Role of Alternative Media in Developing Environment Awareness among University Students

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Abstract. The pen is mightier than the sword, and the alternative media may become mightier than the mainstream media. This is not a mere conjecture the process has already begun. The alternative media has emerged as a key player in promoting the various environmental related issues which is not getting mainstream media attention. The recent technological developments have reduced the cost of production dramatically. The speed of internet has increased with the development in the data transmission technology. This development has provided in the form of new media, a very strong tool of communication to challenge the monopoly of traditional mainstream media. The alternative media particularly Internet, Mobile Communication, Visual Radio, Ham operators, Small and medium newspapers and Community Radio have changed the way we were consuming the media products. Now the consumer is no more a passive receiver of the media content but involved in the process of collection, selection and dissemination of information. There is a large number of people who believe that media can be used as a tool for social change. The large number of people involved in developing and disseminating information can be a great source of information for hundreds and thousands of people all across the world.

In this modern society alternative media has emerged as a very strong force which is spreading issues of environmental awareness in a unique manner. A number of debate and discussions are taking place through the various social network sites. India is a young nation where more than 5o percent of the population in young and actively using alternative media as a primary source of information and communication. The present study is an attempt to understand the nature, role and impact of alternative media in spreading the environmental issues. The focus is to analyze the various issues that are frequently discussed by the young ones. The objective of the study is:

(1) To collect information about various alternative sources of information popular among the students;
(2) To study the media behaviour of students;
(3) To analyse the awareness about the various environmental issues ;
(4) To know about the most preferred medium of communication;
(5) To know about the actions taken by the students.

Keywords: Alternative media, Science, Awareness, Environment, Impact, Communication

Communication Hierarchy Analysis and Decision Making in Science and Technology Communication: How Much of What is Adequate for Desired Impact of Communication

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Abstract. Science and the method of science and the subsequent analytical techniques have been the hallmark of modern development, be it in sciences or even in humanities. These analytical techniques have increasingly been put to use across the entire spectrum of knowledge generation and its application. Why science communication should be away from developing these tools for democratising the subject in the sense that more and more human resource can be turned friendly to science communication and hence to the advanced world of sciences. It is high time that science communication should be demystified from the guarded codes of inclinations and experience to simpler training of quantification of ingredients of science communication and be allowed to flourish in a increasingly science consuming society.

Communication Hierarchy Analysis has potential to be able to fill this gap. For this it has been found appropriate to expand the horizon of science communication and the concept of total transfer of knowledge has been introduced and this has been named Total Communication. For this to be able to make the concept vividly understanding, communication of technology has also been considered within the greater realms of science communication as we generally tend to apply the term to general use. This paper recognises the very fact that different levels of communication produces distinctly different results. Emergence of such an analytical tool required higher level of understanding of the subject of science communication in terms of various skill groups such as linguistics, story weaving, communication and entertainment mix, illustrations including graphical, etc. Sooner it can be done, faster the objectivity of sciences can be imparted to science communication in particular and communication in general.

Keywords: Science communication, Science and technology communication, Communication hierarchy analysis, Total communication, Decision making tool

Introduction

Communication is a complex phenomenon that apparently looks simple. Various inherent process involved in communication are–the ‘source’ identifies the subject (topic) to be communicated, identification of the ‘target’ (to whom it is to be communicated), the form of communication, the level of communication, the amount of knowledge intended to be transferred, the dimensions (degree) of communication tools (voice, text, image, etc. and their mix), the objective, etc. The act of communication also involves simultaneous evaluation of the ‘receptivity of the ‘target’ and gap between ‘achieved’ and ‘intended’ level of the understanding it has made on the target.

In face to face communication this simultaneous correction are made impromptu and hence is most preferred for communication with higher prerequisites such as curriculum communication (teaching). The capacities to achieve these corrections make one a good or a poor communicator (teacher). It is for this very reason that interactive form of communication provides best results and curriculum teaching essentially employs this in conventional terms. This means that a communication other than face to face has to integrate these ingredients to be the most effective and how to achieve this is the key to its success. This paper attempts at quantifying the various parameters and helping arrive at the right mix for a communication. The clarity and quantification practised in science can help communication decode the abstract terms of likes of skill, understanding, etc. and put in place a well defined measure for assessing the content and its likely impact on the target of communication.

Principle of ‘Communication Hierarchy Analysis’

Different forms of communication achieve different results. Sometimes it just provides information. This again can be amongst the peers or homogeneous groups or between two groups where one sits higher on the knowledge ladder and the other at lower levels. It is, at times derives different perspectives of the same information, sometimes diagonally opposite. Adoption of a new device in the automobiles to control pollution has different meanings an environmental scientists and to an ordinary taxi driver. This difference in perspectives generated by communication (by difference in the knowledge level hence different perception generated by a communication) makes way for various information grades in communication tools, which is necessary for amalgamating communication with complicated knowledge having societal implications and this is quite possible in science and technology (S&T) communication. It is therefore thought prudent here to analyse communication tools on the basis of this hierarchy in objectives and impact; delivery and acquisition; and literacy and knowledge prerequisites.

While first order hierarchy should infer hierarchy in basic communication delivery menus, such as speech alone, or together with text, visuals, caricature, audiovisuals, graphics, etc., the next order of hierarchy can definitely be objective linked. Here elements deriving importance should be retention, impact, knowledge level, level of enlightenment, etc., objective linked hierarchy is associated with the objective aimed to be fulfilled while carrying out communication activity. The author first proposed in the year 2009, the Principles and Basis for 'Communication Hierarchy Analysis' to understand the selection of the type of media, objectives achievable against the subject being taken up for communication activity and its nature. Ensuing classification satisfies this hierarchical understanding and the analysis subsequently completes the process involved.

Assumptions and Elaboration

In order to develop the principle of Communication Hierarchy Analysis, a new concept named 'Total communication' was proposed. It has made possible where the human race stand today. At the very basis of this hypothesis, lies the need for the communication. But then, the question arises, what level and form of communication. This paper has already recognised and discussed above the very fact that different levels of communication produces distinctly different results.

Emergence of science required higher level of communication skills and all higher or derived forms of knowledge emerging out of scientific advancements necessitated more effective forms of science communication. The concept of Total Communication is ever developing as itself the very tenets of science and technology. The concept of Total Communication necessitates highest extent of communication such that the source of that communication on knowledge front is matched by the receiver or the target to a great extent after the communication process is over.

'Communication Hierarchy Analysis'

Dimensional hierarchy
Verbal communication
Written communication
Visual communication (exhibits and displays)
Audio-visual communication
Hands on communication

Objective linked hierarchy
Information
Appreciation
Understanding
Learning
Total knowledge acquisition

Subjective linked hierarchy
Mass communication
Specialised mass communication such as for children
Education (training and teaching)
Science and technology (mass) communication and
Expert peer group communication

The Dimensional hierarchy is the first order analysis and deals with the very obvious analysis in communication. Whereas verbal mode is the basic but it is most essential. It can reach to every kind of target mass and it can also be utilised to reach common and specialised target audience. At the top of the hierarchy, here we have Hands on communication, which leaves minimal knowledge difference level between the source and the target. The methodology adopted here ensures that almost every aspect associated with the subject of communication is transferred to the target. The application of this method needs to be chosen keeping in mind the above effect (objective) namely Total Communication in mind, which the communication exercise is required to fulfil.

The Objective linked hierarchy is analysis based on objectives achievable through a communication activity. Information may not require as deep involvement of all the acquisitive learning faculties of the target involved. Total knowledge acquisition on the other hand, requires greater involvement of acquisitive learning faculties of the target. The results here are of highest order.

Subjective linked hierarchy analysis seeks its basis in the subject of the communication activity. For mass communication the generalist strategy is put to use which takes note of some basic commonly understandable concept to be communicated. Vocabulary usage depends upon this minimum understanding of the target associated with. Expert and peer group communication involves highly technical concepts and vocabulary in communication as 'expert' here becomes the 'generalist' (target). This group puts a lot of emphasis on the necessary skills and expertise of the communicator as well as of the receiver (target). Table-1 discusses the prerequisites demanded for the source and the target for Subjective Linked Hierarchy.

Table-1: Prerequisites for Subjective Linked Hierarchy

Subjective linked hierarchy (increasing order)	**Source prerequisite**	**Target prerequisite**
Mass communication	High knowledge level	Threshold understanding
Specialised mass communication such as for children	High knowledge level; Good communicative skills	Threshold understanding; Comprehensive skills
Education (training and teaching)	Higher knowledge level; Good communicative skill; Good assessing skills	High comprehensive skills; Expressive skills; Lower knowledge level
Science and technology (mass) communication	High know level; High communicative skills; Good simplification skills	Threshold knowledge level; Comprehension skills;
Expert peer group communication	Highly knowledgeable; Reasonable communicative skills; High comprehension	Highly knowledgeable; High comprehension; Reasonable communicative skills

Decision Making and Communication Hierarchy Analysis

Most of the time two parameters at the most are provided to the communication designer – the target audience and the objective. Entire strategy for effective communication now involves a series of processes involving identification, quantisation and analysis before deciding exactly upon the format and content of communication to be used. Following series of steps are undertaken to complete the process.

1. Target audience–Provides information and enables decision on Dimension Hierarchy Objective–Provides information and enables decision on Objective Linked Hierarchy
2. Both, the Target audience and Objective together enable decision on Subjective linked Hierarchy
3. These decisions enable quantification of level of Source prerequisites and Target prerequisites for each hierarchy
4. The combined output so collected from all the groups enable the communication designer to work out the nuts and bolts of the communication solution for a particular situation

This entire process has been explained graphically through a flow chart in Figure-1. The critical steps and issues involved during designing a communication solution is indeed a complex tasks requiring characteristic evaluation and deciding upon the structure and ingredients of a communication solution which will bear the greatest impact upon the target prescribed. Target audience and Objective when passed through the Dimensional Hierarchy Analysis and Objective Linked Hierarchy Analysis are able to decide upon the prerequisites based on these. That means now we know the requirements on the part of the source and the target as regard to the dimensions of communication must be involved. From consideration on the objective too the exercise is able to quantify prerequisites for both. It is now for the designer to employ Subjective Linked Hierarchy Analysis and complete the process for obtaining the solution for a communication need.

Science and Technology Communication

Science and technology (S&T) communication belongs to the Subjective Linked Hierarchy in the Communication Hierarchy Analysis. The need for S&T communication arises from the input provided by the previous two hierarchies, namely, Dimensional Hierarchy and Objective Linked Hierarchy.

The process of Communication Hierarchy Analysis

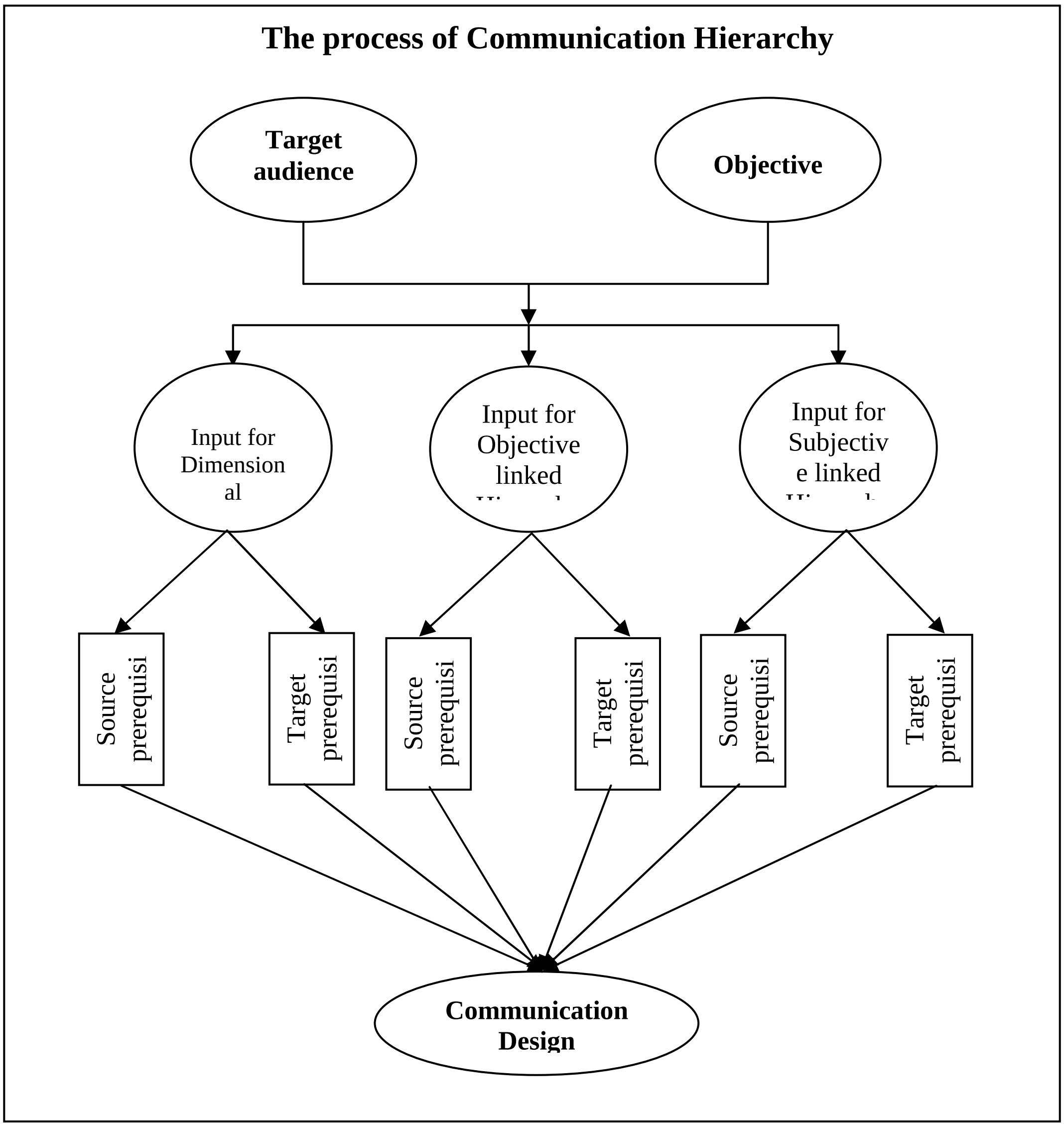

Figure. 1 Illustration depicting decision making requirements during designing of a communication solution

A communication designer now needs to take several set of decisions pertaining to source & target prerequisites and content prerequisites except one or more set which has been provided as the preliminary information. There emerges clear cut picture now for the source and target prerequisites after the entire analysis. It is now extremely easy task to draw lines for the content and hence its presentation.

While working for science and technology communication, it can be easily understood that the hierarchies belong to higher level. Complex subject relates to possessing higher degree of hierarchy and difficult becomes selection of the objective. Also, if you are required to select higher degree of hierarchy in any of the two groups, then there are some threshold prerequisites for the target to have already acquired in terms of the knowledge level associated with. This can very well be defined by the communicator involved. More importantly this can not be universal, every communicator has to evolve for his way of handling of the communication tasks and his expertise with the tools of communication to be put to use. But one thing can be very well understood that this is due to the different level of experience, skills and knowledge level of the communicator (source) and hence all the more necessary for a communication designer to specify the source prerequisites very carefully.

Technology communication in particular has another dimension. It is of transfer of technology. This is much more complex a task but relatively easy to carry out if all the requirements are met, as the 'source' and the 'receiver' both are in the highest state of effective 'transmission' and 'reception' of knowledge.

Conclusion

In designing a communication, there are several components (ingredients), which are required to be decided on the basis of the impact likely to be achieved. Conventionally it has been purely on the basis of experience and knowledge of the communicator. In the era of specialisation, communication is best designed by specialists, namely, communication designer. This is difficult in fulfilling as is difficult in concept level itself. Not anymore with a decision making tool for communication design, called – Communication Hierarchy Analysis. This involves analyzing the communication requirements on the basis of Dimensional hierarchy analysis, Objective linked analysis and Subjective linked analysis. Based on these, source and target prerequisites can be ascertained and the contents of the communication, its format and presentation can be worked out. This tool can be an asset especially while working in the area of science and technology communication.

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CSCs Towards e-Villages

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Abstract. Indian Government has initiated Common Service Centers (CSCs) across the country for the rural folk to obtain all the services through Internet. In Tamilnadu, the CSCs have been functioning since 2008 and at present around 2047 do exist. The present study is aimed to find out the services preferred by the users, the services offered, the challenges of CSCs towards sustainability and the citizens' perception. Tiruvannamalai district was selected for the study. Case study and indepth interview method was employed and officials in the TNeGA, SREI, operators and users of the CSCs were interviewed with semi-structured questionnaire.

Keywords: Common service centers, e-Governance, ICT, Sustainability

Introduction

Information and Communication Technologies (ICTs) are considered as the strategies to transform the world and to achieve most of the Millennium Development Goals (MDGs). ICTs have achieved a great extent of improvement in transparency, accountability, service delivery speed and lower service charges in the service process. E-governance can be explained as the use of Information and Communication Technologies by Government agencies to deliver the services to the citizens. Many of the Governmental agencies have succeeded in delivering the low cost, speedier and efficient services to the public.

India has witnessed so many successful ICT initiatives. The e-governance services have enhanced the efficiency of Educational, Revenue, Social Welfare, Transport, Passport, Commerce and other such services in India (Kumar & Best, 2006). Many researchers have documented the success stories of these initiatives. On the other side, there are researchers who studied the sustainability and applicability of these initiatives (Heeks, 2002 and Kumar & Best, 2006). Heeks explains about three categories–complete failure, where the goals were not achieved; partial failure, where the major goals were not unattained and successful, where most of the goals were achieved.

Shaun Goldfinch (2007) quoted that, 'the majority of the ICT developments are unsuccessful, particularly 'large' ones over $10 million. Indeed, 20-30% are abandoned altogether, while around half are over time, over budget and/ or do not deliver on expected applications or performance'. In India many of the rural based initiatives have failed to stand as the years went by. Chiraag Internet Centers were closed by the early of 2009, due to various reasons. Howard (2008) commented on such failures as, "the lapse is due to the many ill executed or misguided projects that failed due to limited local but-in, flawed economic models, inadequate training, and/or use of inappropriate equipment. From the perspective of donors, the most obvious failure of Information and Communication Technologies for development initiatives was that few were able to persist without their continued intervention and financial support, leading to an impression that Information and Communication Technologies for development projects are largely unsustainable".

Based on our various personal field visits to the rural ICT initiatives in the Southern India, have clearly showed that none of them are sustainable. It still exists as the initiators strongly depend on the funding from donor agencies. The dominant issues were lack of monetary benefit, lack of long term strategies, lack of periodical evaluation and research, lack of need and community based content creation, lack of local participation and lack of trained technical personnel to solve the problems without much delay. Even after the state's rural ICT profile has not showed positive response, there are agencies to implement the project. At this juncture, Government of India has initiated Common Service Centers (CSCs) across the country to make even a rural folk to obtain computer literacy and all the services at their door step irrespective of distance, space and time.

Common Service Centers (CSCs)

Ministry of Information Technology, Government of India had set up the National e-Governance Plan, through which it has planned to initiate a Common Service Center (CSCs) for each six villages all over the country. The

Central Government funds and the state government implements the project through Public Private Partnership (PPP). Through bidding, the Government has selected the Service Center Agencies(SCAs) to deliver the services through Village Level Entrepreneurs(VLEs). Every CSC is equipped with Desktop PC/ laptop, printer, web camera, digital still camera, scanner and a high speed broadband connectivity. The total infrastructure costs around Rs. 1, 62, 000 and at the time of installation the VLEs need to pay Rs. 42,000 and the remaining amount will be arranged as loan and the VLEs are expected to pay back in installments. The VLEs were selected in consultation with the local bodies and screening, so as to make sure that the VLEs would serve the society. They should have the minimum pass of school education and they were trained by SCAs. It is mandatory for the CSCs to offer Government services to the citizens in the areas of e-governance, education, health, agriculture and commercial.

Common Service Centers (CSCs) in Tamil Nadu (TN)

The Government of Tamil Nadu through Tamil Nadu e-Governance Plan (TNeGP) has been initiating one CSC for three villages since 2008 taking one step ahead of the National plan. Two private firms were selected as the SCAs– Sahaj SREI and 3i-infotech through out the state. 3i-infotech has withdrawn from the scene after initiating the CSCs in all districts of Tamil Nadu except Chennai, Dharmapuri, Krishnagiri, Tiruvannamalai and Vellore districts. The VLEs are left without any help. Sahaj SREI has been operating in the four districts–Dharmapuri, Krishnagiri, Tiruvannamalai and Vellore. They are entrusted to provide Government services like land records, registration, issue of certificates, Government schemes, employment exchange, ration cards, electoral services, pension schemes, transport and public grievance. In Tamil Nadu there is a total of 5440 CSCs.

The Study

The broad objective of the present study is to assess the effectiveness of these CSCs initiatives in bringing change in the community and the contingency factors which affect the change in the existing situation. This study is aimed to find out the services preferred by the users, the services offered by the CSCs, the challenges of CSCs towards sustainability and the citizens' perception on the CSCs.

The researchers have adopted the intrinsic case study methodology along with the indepth interview. Everett Rogers (2003) comments that, "the usual survey research methods are less appropriate for the investigation of innovation consequences than for studying innovativeness. Extended observation over time or an in-depth case study is usually utilized to study consequences. Diffusion researchers have relied almost entirely upon survey methods of data gathering, ignoring the study of consequences, as the usual one-shot survey methods are inappropriate for investing the effects of innovations. An innovation's consequences cannot be understood simply by adding an additional question or two to a survey instrument, another hundred respondents to a sample population, or another few days of data gathering in the field".

The researchers have selected Tiruvannamalai district as it is backward socially, economically and in lack of computer literacy than the southern districts of Tamilnadu and also the services are implemented to the full extent. The district has 367 CSCs in the ratio 1:3. Interviews were conducted with 50 respondents which include officials in the Tamil Nadu e-Governance Agency (TNeGA), service providers (SREI), VLEs, CSC operators and users of the CSCs in various CSC villages with semi-structured questionnaire.

The Results

The study has clearly revealed that the project needs a midterm evaluation and different approach in the service implementation. The findings are discussed as follows:

Frequently used services

When the services, which are frequently accessed, are ranked, the offline services topped the list while the access to Government services left behind. The people have widely accessed the recharging service to recharge their mobiles and DTH. Photocopying and photo printing was used frequently as the villagers otherwise have to travel far to access these services. Very few people have sent emails and the youth have downloaded songs from the internet. Youth have also used the e-learning services. People also access the online ticketing facilities and the government certificates whenever they need. Many of the VLEs and CSC operators have expressed that they had to introduce the DTP and photocopying services to increase the users and gain income. They acknowledged the inefficacy of e-services alone to gain income in a rural setup. Some of the VLEs have even raised income by taking photographs to the village people. Initially, the majority of the VLEs have reported the centre has more than 15 visitors in an average every day. But later it has been revealed that most of the centers have stationary items in their shop and the people come for those purchases.

e-Governance services

The CSCs provide space for applying the Government certificates through online. The VLEs are authorized to submit the forms online after thorough inspection and to process the application to the district officers. In turn, they would get the certificates to supply them to the applicants in a due course. Most of the Indian villages are not connected with frequent transport. This would allow the people not to travel a long distance and no urge to wait in a long queue from morning to evening. Moreover these processes avoid the middlemen and promises transparency. But in some of the villages, the VLEs and the operators have said that most of the services which Government has introduced are yet to be initiated.

The people are enabled to make their petition every Monday to the District Administrative Officer (The District Collector) for all their problems to be solved at the District headquarters. So at present, the TNeGP has set up a provision that the people need not travel a long distance and they can file their petitions in the CSCs itself. But the Government officials do not open these online petitions and rectify them. It forces the people to lose their hope on e-governance system. Even in applying for the certificates, the incomplete forms are not reported back immediately. They are rejected, without the applicants being uninformed. So the people prefer to go in presence and get things done without waiting for a long time.

E-learning

With the partnership with Indira Gandhi National Open University (IGNOU), the CSCs offer diploma degrees and certificate courses on computer to the village people. Many of the school drop outs, young women and children avail these services. But the question arises whether the package was really "e" or not. Because the course material was completely stored up in the system and it seems like a multimedia module. But the interactivity feature of the module (which makes a slow, step by step learning possible) allows the village youngsters and children to learn computer and complete diploma and certificate courses.

Monetary benefit

The VLEs are not paid by the Government. But the private partnership enables them to receive subsidies and gifts. The private insurance and banking agencies are tied up with the CSCs for insuring and buying property or vehicle. If the VLEs find customers for the agencies, they would be gifted subsidies. So the VLEs try to publicize the benefits of private services and not the information service of the Government, which will be of little benefit. Moreover, people are still trained to invest their money in various businesses.

The installation amount forces the VLEs to charge higher amount as they want to get rid of the debt at the earliest. But the poor people feel they are charged high, which in turn minimizes the number of visitors. The Government has offered many schemes before the CSCs were initiated, but most of them are not yet introduced. So the VLEs feel as if they are cheated and they could not make profit out of it.

Social prospects and challenges

Though the VLEs are men, majority of the CSCs are run by female. They either allow their wives to look after the CSC or select the young girls in the village to look after the CSC as they strongly believe in the managing strengths of women and trustworthiness. This changes the village scenario and allow for the participation of the women in public participation, discussion and decision making.

There is a serious issue of caste (social class) discrimination. The CSCs have to be set up in the common place where all the people can access easily. But if the selected VLEs belong to the lower social class, they do not either own a place in a common place or get for rent easily. One of the VLEs has reflected that he has to pay more than it deserves as he belongs to the lower social class.

The uneducated old aged people do not understand the applicability of the eservices. So at time, they create problem and the VLEs have to struggle a lot to get things settled. The economically deprived people do not use the services as they think the technology is for the rich. But the rich people threaten and try to influence the CSC staff to get the benefits at the earliest. Only the literate folks access and browse through the internet for various things. The illiterates get the services through the technical support of VLEs.

Technical issues

CSCs are not conferred with fast broadband services. In the middle of the process, the connection gets disconnected and the uneducated get irritated of this technology and avoids to use eservices. The technical support was also very low as the technical errors are not rectified at the earliest. These factors force the VLEs to prefer offline services much than the online services.

Recommendations of the Study

1. Rather than partnering with the private agencies, the SCAs should try to hold partnership with the local bodies. SCAs generally sign MOUs with the private bodies but without knowing the real need of the people. A need based study should be implemented to evaluate and improve the project.
2. The goals of the services are yet to be refined and it is a doubt whether the services would contribute to the poverty reduction. The researchers could not find benefit for any of the citizens apart from applying the online certificates. It should be also noted that people would not need certificates through out the year. So some amendments need to be made for consistency and sustainability.
3. It has been evidently proved that the Government has been using these services for election strategies as the processing fee is minimized for a short period to access the eservices. If they increase the fee, the people would not depend on it more and the model would fail. VLEs have to charge as they have invested more. The Government can move the CSC's control either to the Self Help Groups or local administrative bodies and cut off the rates. So the entire community would be benefited.
4. There is a need for some campaigning strategies to increase awareness among the rural users especially the aged and uneducated, as they are the strong opinion leaders of the society.

Conclusion

The world is moving towards the mobile revolution in a rapid pace. The developing countries are testing the m-commerce, m-governance and so many other m-developmental initiatives. Mobile has deep rooted in the Indian society than any other medium. People of all classes use the mobiles. Rather than distributing free television sets, the Governement can spend on installing new applications which would allow the people to access all the services not even at the door step, but at their private rooms. There are other serious issues to be dealt within the society before taking internet and computer. And moreover, the mobiles are user friendly than the computers. So it is the time for the Indian Government to stop spending money on the rural ICT initiatives and try to improve the research on m-governance.

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Communicating Bioinformatics

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Abstract. With the advent of computers, humans have become 'data gatherers', measuring every aspect of our life with inferences derived from these activities. In this new culture, everything can and will become data (from internet traffic and consumer taste to the mapping of galaxies or human behavior). Everything can be measured (in pixels, Hertz, nucleotide bases, etc), turned into collections of numbers that can be stored (generally in bytes of information), archived in databases, disseminated (through cable or wireless conduits), and analyzed. We are expecting giant pay-offs from our data: proactive control of our world (from earthquakes and disease to finance and social stability), and clear understanding of chemical, biological and cosmological processes. Ultimately, we expect a better life. Unfortunately, data brings clutter and noise and its interpretation cannot keep pace with its accumulation. One problem with data is its multidimensionality and how to uncover underlying signal (patterns) in the most parsimonious way (generally using nonlinear approaches [1-3]). Another problem relates to what we do with the data. Scientific discovery is driven by falsifiability and imagination [4] and not by purely logical processes that turn observations into understanding. Data will not generate knowledge if we use inductive principles. The gathering, archival, dissemination, modeling, and analysis of biological data falls within a relatively young field of scientific inquiry, currently known as 'bioinformatics', 'computational biology', 'biomolecular informatics', or 'computational molecular biology'. Some terms are more restrictive than others and some also refer to the use of biological macromolecules as computing devices (e.g., computational molecular biology). I have chosen to refer to this data-driven field as bioinformatics.

Even though technology and information is increasing in biological sciences, many students are being left behind. Bioinformatics is one such field where students are not being properly informed of the opportunities. Therefore, science teachers need ways to teach this subject to their students. Activities for students on bioinformatics should be inquiry-based and relevant to their lives. Before activities can be completed, a brief history of the subjects is needed. In addition, the basic background information of genomics and bioinformatics is presented. Applications in science and in their lives is shown to allow students to understand relevance of bioinformatics. The activities devised begin with students using a chromatogram to obtain a gene sequence of about five base pairs. After obtaining their gene, the student complete by hand a worksheet in which they match their gene to the one out of five example genes. This activity is devised to allow the students to fully appreciate that the computer can accomplish in a matter of seconds when humans take hours to complete. Afterwards, they use the actual bioinformatics computer search tool to seek a match to their gene sequence. Once they have found a close match, they report on the structure and function of their gene. These activities are devised to allow the students to appreciate what scientists do and perform the same tasks scientists do everyday in an actual lab setting. In addition to using the information and activities in the biology curriculum, they can also be used in the mathematics curriculum, especially Discrete Mathematics and Advance Placement Statistics. The activities provide an ideal opportunity to integrate mathematics and science education. The activities are also suited to collaboration among computer science and biology teachers. In collaborating with a biology teacher, a computer/technology skills teacher could design a lesson on bioinformatics. In society today, the uses of technology are rapidly increasing and improving. Teachers need to work to stay informed on new technologies to be able to inform students of the many opportunities available. Through explaining bioinformatics to students, teachers give students a head start into the opportunities available. The information and activities provided can help teachers accomplish this task.

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Scienfotainment: Popularising Science through Entertainment

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Abstract. The essence of Science Communication lies in establishing the fact that science is a necessity that stems out of life problems itself. Formal education may propel Science but the inventive capacity developing in the course of meeting those life problems in an uneducated individual can any day change the shape of the world. The only lacuna towards this is promotion of that scientific intellect that may be budding in any orthodox tribal community of Madhya Pradesh or some poor village in the islands of Trinidad and not necessarily in a sophisticated R&D laboratory of a multi-national company. Any local invention taking place in a greased congested motor garage could just have potential to give jitters to the R&D expert team of an automobile giant. Identifying a talent of the sort & creating its visibility from a local arena to a global platform through Science talent hunt is the gap that Science Communicators can fit in. In my opinion, communication can serve as a mediator to link local talent to the outside world through the concept of 'Scienfotainment' which would amalgamate Science with entertainment and magnify its impact. This would be a leap towards promoting scientific & rational attitude through novel science talent shows that can be telecasted worldwide. Patents can be granted to those inventions which hold commercial viability thus benefitting the local talent. Global Science communication would emerge as a new face evolving from the local scientific communicators struggling to get better visibility in today's time.

Proposed model

Convergence of local Science Graduates/ Post –graduates/Academicians with interest/background in communication
Dig out local & indigenous inventive genius in all possible scientific arenas from a garage boy (mechanical field) to a farmer who might unknowingly be cultivating a new disease resistant variety crop by specific crossing (genetics)
Laying the foundation of **"Scienfotainment Concept"**. Amalgamation of Science with entertainment. Utilise local media tools (electronic & print) to organize Science talent shows (much like dance & singing & reality shows like Dance India Dance, Meri Awaaz Suno, Big Brother etc.)
Identifying Channel Sponsors & Creative Heads (National level) to feature a serial based on the novelty of the concept & the innovation mix it can offer to the public and even the innovation incubator firms which might readily promote a feature of the sort.
Taking care of legal implications: Patents may be granted to such innovations that have the potential of commercial exploitation.
The Concept of 'Scienfotainment' may be picked by international channels as well (In the same way as the reality show concept was taken up by India most readily; with the difference that this time India will have something new to offer to the globe).

Application extents

- Promotion of Science & Scientific temper through communication channels
- Filling the gap between local & global science communication channels in a glamorized manner
- Morally encouraging the local inventive genius

- Financially crediting the inventive genius(depending on patentability criteria of commercial exploitation)
- Opening a new creative module in entertainment business
- Signifying the outreach of Scientific Communicators

Analytical study on Health Communication Theories and Models in Communicating Health Messages through Media Strategy: with Special Reference to Women

Srijothi Pichaimuthu

Abstract

The deadly H1N1 influenza virus that's fueling fears of a global pandemic is combination of pig, human and avian influenza strains. The findings may resolve some uncertainty about the nature of the virus, but much is still unknown about its origins and effects for most of the people. In recent years health professionals have developed a growing appreciation of the critical role that communication plays in healthcare. The effective communication of information on medical technology conditions, diseases, medicines and healthy lifestyles has played an important part in the improvement of the health status of the people widely. At the same time, it is hard to ignore the cynical impact that ineffective communication can have within the health issue arena. This recognition of the impact-both positive and negative-of communication in dealing health issues and communication is generating upward interest in the field of health communication

The media coverage on public health information and crisis is gathering momentum with advancement of science and technology. It plays an essential role in informing, communicating, educating and sensitizing the public on global and local health issues. And also has the potential to influence the government's decision-making on health care policies. But, during the swine flu outbreak in 2009, both traditional and new media were largely criticized for sensationalizing the issue as India was one of the least affected countries in the world.

The Health communication message through different media strategy reaches the people in different bang to create various effects in the society. The theories and models of health communication explain the strategy of communication channels reaching out the target with messages and also explain the attitudes of people behaviors and practice through communication. The aim of the research is to analyze influencing effectiveness of health communication messages from various communication channels among women and comparatively analyze with health communication theories and models. Perhaps the media coverage and different kinds of communication of the swine flu through various media has outbreak in 2009 in the India. The objective of the research is obtained by the survey method and in-depth interviews. The gathered opinions are comparatively analyzed with the health communication theories and models to find the effective results.

Keywords: Health communication, swine flu, media, strategy, messages, behavioral changes.

Introduction

Health communication encompasses the study and use of communication strategies to inform and influence individual and community decisions that enhance health. It links the domains of communication and health and is increasingly recognized as a necessary element of efforts to improve personal and public health. Health communication can contribute to all aspects of disease prevention and health promotion and is relevant in a number of contexts, including (1) health professional-patient relations, (2) individuals' exposure to, search for, and use of health information, (3) individuals' adherence to clinical recommendations and regimens, (4) the construction of public health messages and campaigns, (5) the dissemination of individual and population health risk information, that is, risk communication, (6) images of health in the mass media and the culture at large, (7) the education of consumers about how to gain access to the public health and health care systems, and (8) the development of tele-health applications.

For individuals, effective health communication can help raise awareness of health risks and solutions provide the motivation and skills needed to reduce these risks, help them find support from other people in similar situations, and affect or reinforce attitudes. For the community, health communication can be used to influence the public agenda, advocate for policies and programs, promote positive changes in the socioeconomic and physical environments, improve the delivery of public health and health care services, and encourage social norms that benefit health and quality of life. Over the last 50 years, social scientists have advanced various theories of how communication can influence human behavior. These theories and models provide communicators with indicators and examples of what influences behavior, and offer foundations for planning, executing, and evaluating communication projects (Piotrow, Kincaid, Rimon, & Rinehart, 1997).

The World Health Organization (WHO) defines health communication as a key strategy to inform the public about health concerns and to maintain important health issues on the public agenda. Health communication is directed towards improving the health status of individuals and populations. According to that definition health communication does not include all health-related media texts but only those engaged in positive effects on health. Thus health communication research is concentrated on finding out what kinds of health stories are published and what kind of health messages reach the general public to bring the effective changes in behavior among them and also if health facts are accurate and influencing and how health stories affect the people through different communication strategy.

Health and illness are among the most popular topics in today's media. Health and medicine are not only newsworthy but are used everywhere in all the media from editorials to soap operas and from books to Internet. The Economist on November 13, 2009 in its article "Predicting the path of the swine-flu pandemic" reported the first pandemic of the 21st century will expose stark differences between the world's rich and poor, predicts Margaret Chan, director-general of the World Health Organization. The reason that the health communication gets all the much acclaimed attention is because health and well-being are issues that concern everyone. On one hand medicine is a matter of death and life so medical actions are good items for dramatic - factual or fictional - stories, too. On the other hand today's health care system and health professionals are more interested in co-operation with the media.

The recent hardtalk on the news media related to health issues was the swine flu pandemic outbreak worldwide. The sub type of Influenza A [H1N1], was first reported in Mexico on 18th March, 2009 and then spread to neighboring United States and Canada. As on 8th June, 2009, World Health Organization has reported 25,288 laboratory confirmed cases of influenza A/H1N1 infection with 139 deaths from 73 countries spread over America, Europe, Asia and Australian continent. The flu was comparatively less vulnerable than the regular seasonal flu with lower casualties. But the rate of transmission of the virus across the continents within a short time span made WHO declare the swine flu pandemic alert as Phase 6 in June 11, 2009. (Dumar, 2009)

The media has a set of standards and ethics to adhere to at propagating information, and plays a more crucial role in reporting global health crisis situations. Increasing competition for readership and the TRPs has made the traditional media prioritize its commercial interests. News journalism in specific is often questioned for its credibility and sensibility with the general public relying much on the news stories and the media coverage for their information. The recent swine flu outbreak in 2009 equally alarmed the WHO and people around the world. The medical professionals and the research scientists themselves were lost for explanations or predicaments, whatsoever on the A (H1N1). At this point, with the globalization of media content and the advancement of communication technologies, our world was enveloped, rather bombarded with message explosion. The media campaign of the swine flu in India in the newspaper, television and radio medium was considered for analysis.

Swine Flu In India

In India, more than 75% of all infected persons were urban dwellers, suggesting that efforts were concentrated in urban communities. (source: 2009 Pandemic Influenza in India) And so the swine flu outbreak was efficiently contained in the cities by the government through appropriate measures and very sparsely affected the rural regions.

WHO released its weekly situation updates on the global alert and response section of its website. According to the latest release (WHO - Pandemic (H1N1) 2009 - update 95) on April 9th, 2010, over 17700 deaths have occurred worldwide due to the swine pandemic outbreak. In South Asia, limited data suggests the most active areas of pandemic influenza virus transmission continues to be in Bangladesh, where an increasing number of cases have been detected since late February 2009. Overall pandemic influenza activity remained low across the rest of the subcontinent with persistence of low level circulation of pandemic influenza virus in western India.

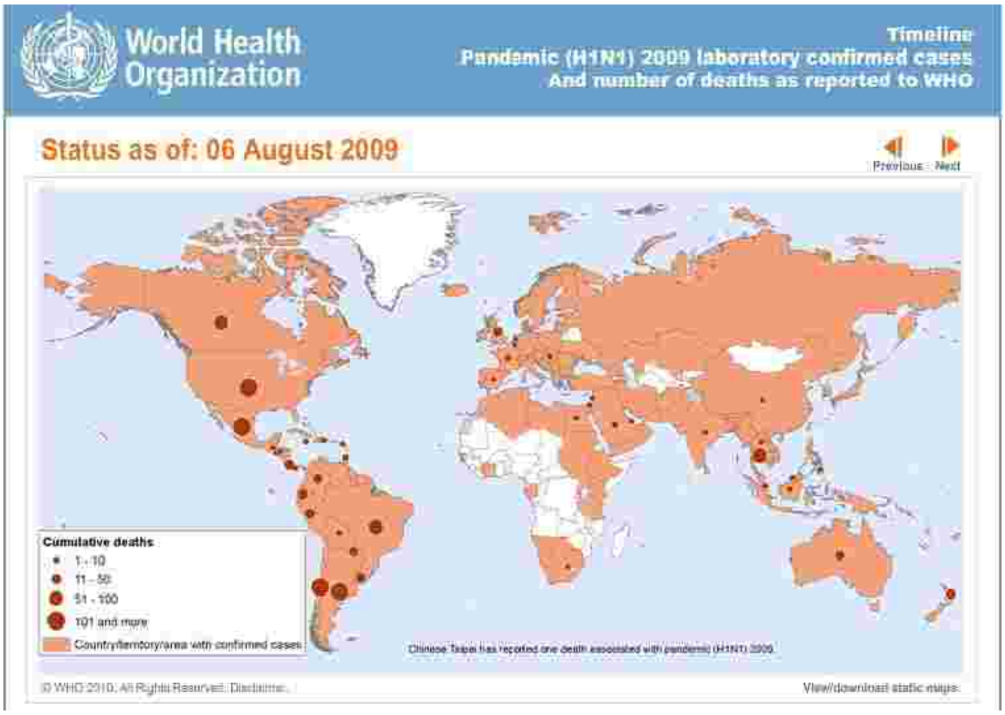

Fig. 1.1 Status of swine flu pandemic in the world on august 6th 2009 (Source: WHO website)

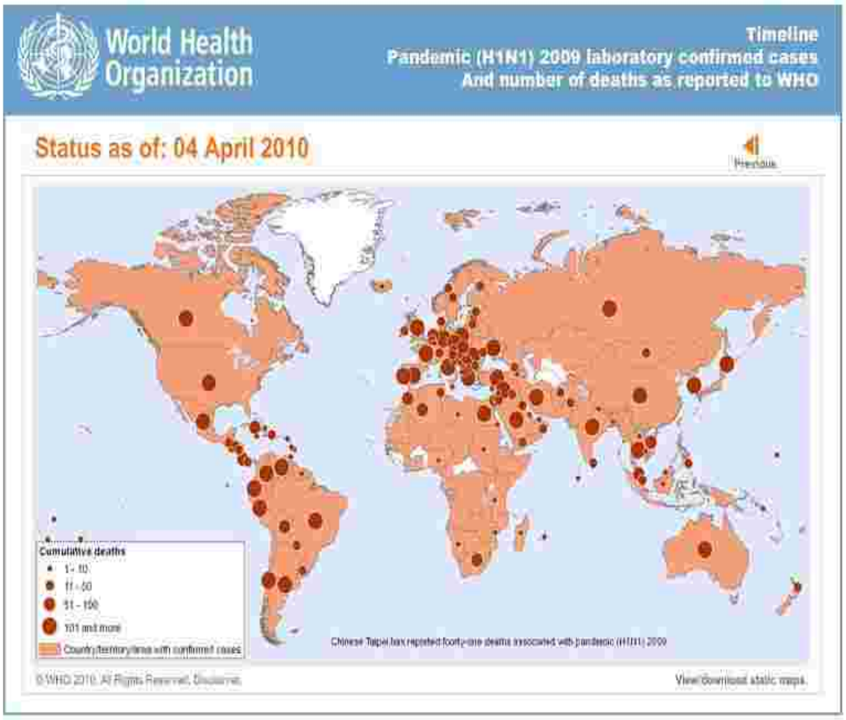

Fig. 1.2 Status of swine flu pandemic in the world on april 4th, 2010 (Source: WHO website)

Swine Flu In Media

The worldwide media coverage of the swine flu pandemic outbreak in 2009 especially shows an in-depth insight into the difference in the way media organizations have covered global issue. Television is by far the most popular medium among all kinds of people. Even so, it's important to pay attention to newspapers to understand what constitutes health care news. Major daily newspapers cover a broad range of health topics more regularly and in greater detail than most television news programs. Television news staffs often look to local or national newspapers for direction on what stories to pursue. But a television coverage and television advertisement veers toward those events that have a strong visual component and away from issues like health policy that require in-depth exploration. (Buresh and Gordon, 2006)

Indian Scenario Of The Swine Flu Outbreak '09

"As on 29.05.2009 there is one imported case that came from U.S.A. There has been no secondary spread from that index case. However, with efficient human to human transmission established and more than 48 countries involved, it is a matter of time that this pandemic strain would come to India. The behavior of this mutant virus among the Asian population cannot be predicted. The virus has the potential to mutate further and become a lethal virus." (Source: Ministry of health and family welfare website)

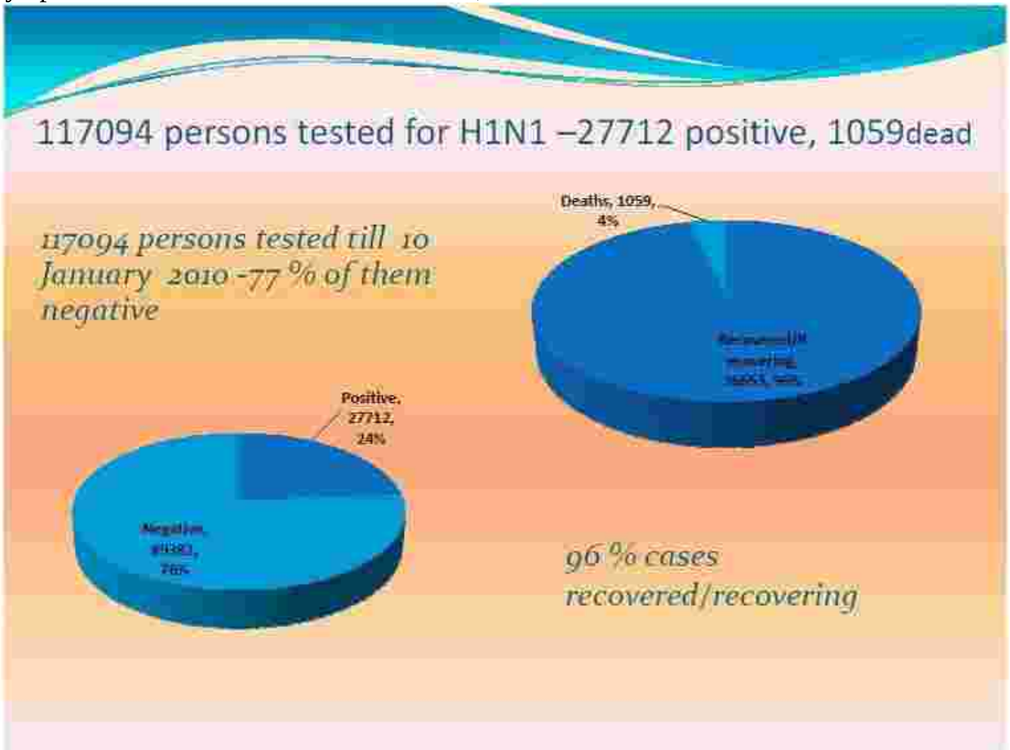

Fig. 1.3 Statics on h1n1 affected indians on january 10th 2010 (source: Ministry of health and family welfare website)

Fig. 1.4 Media campaigns on swine flu awareness in print
(Source: Ministry of health and family welfare website)

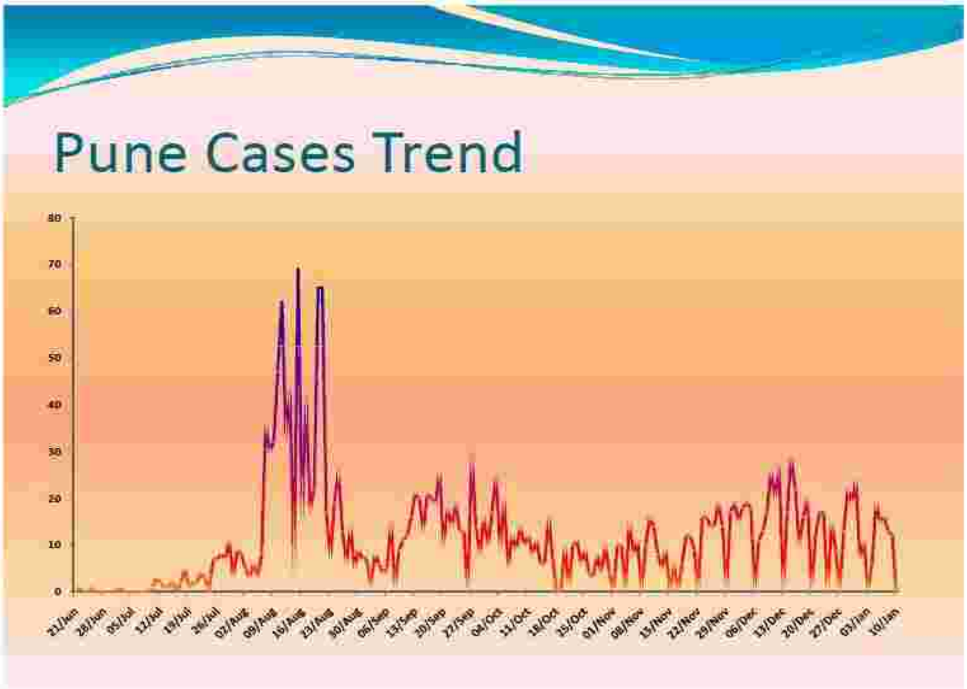

Fig. 1.5 The pattern of city-wise swine flu mortality in pune up to january 10th, 2010 (source: Ministry of health and family welfare website)

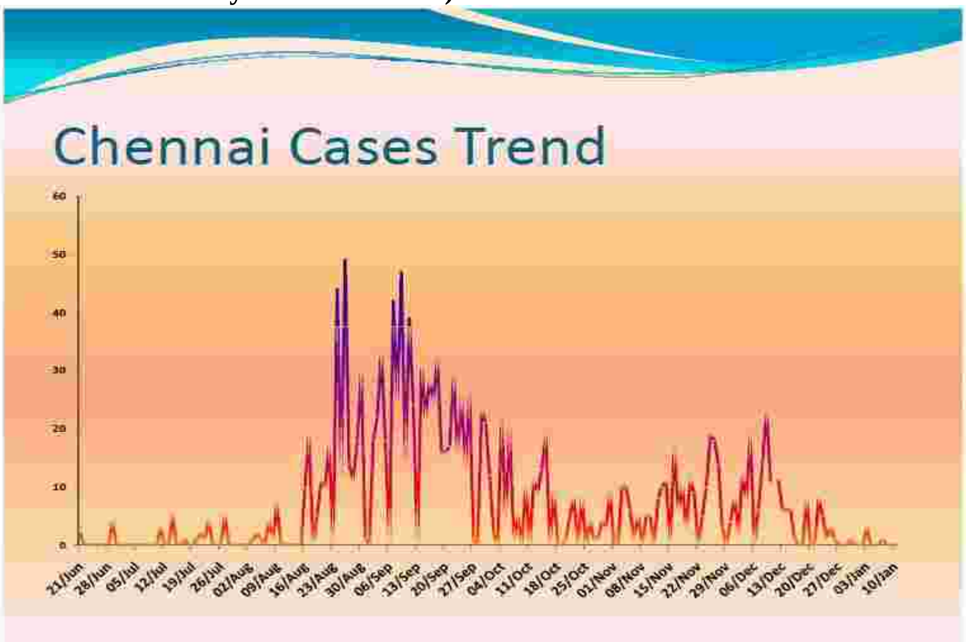

Fig. 1.6 The pattern of city-wise swine flu mortality in chennai upto january 10th, 2010 (source: Ministry of health and family welfare website)

The Press Information Bureau would ensure press releases and arrange for media briefing. The identified authority would only brief the media.

From the data given by Ministry of Health & Family Welfare–Government of India, it's evident that India reported increasing number of swine flu cases since August. And the confirmed case continued to be detected at a lower rate till the end of March 2010. Both Pune and Chennai recorded high mortality in August and September, and slowly reduced due to several factors including government's pandemic intervention strategy and preparedness, climatic conditions and others.

Consolidated Status of Influenza A H1N1

(As on 11[th] April 2010)

Sl.	State	Lab confirmed cases reported during the day	Lab confirmed cases cumulative	Death of Lab confirmed cases during the day	Death of Lab confirmed cases cumulative
1.	Delhi*	0	9695	0	95
2.	Andhra Pradesh	0	784	0	63
3.	Karnataka	5	2243	0	154
4.	Tamil Nadu	0	2089	0	7
5.	Maharashtra*	1	8044	1	429
6.	Kerala	0	1472	0	37
7.	Punjab	0	178	0	40
8.	Haryana	0	1945	0	38
9.	Chandigarh(UT)	0	319	0	8
10.	Goa	0	65	0	5
11.	West Bengal	0	136	0	0
12.	Uttarakhand	0	135	0	13
13.	Himachal Pradesh	0	18	0	8
14.	Jammu & Kashmir	0	108	0	4
15.	Gujarat*	0	1239	0	304
16.	Manipur	0	2	0	0
17.	Meghalaya	0	8	0	0
18.	Mizoram	0	4	0	1
19.	Assam	0	52	0	2
20.	Jharkhand	0	2	0	0
21.	Rajasthan	0	2201	0	198
22.	Bihar	0	7	0	0
23.	Uttar Pradesh	0	1311	0	20
24.	Puducherry	0	39	0	6
25.	Chhattisgarh	0	61	0	11
26.	Madhya Pradesh	0	90	0	35
27.	Daman & Diu	0	1	0	0
28.	Orissa	0	28	0	3
29.	Nagaland	0	2	0	0
30.	Andaman & Nicobar	0	25	0	0
31.	Dadra and Nagar Haveli	0	1	0	1
	Total	6	30352	1	1472

Note:

1. Till date, samples from 132798 persons have been tested for Influenza A H1N1 in Government Laboratories and a few private Laboratories across the country and 30352 (22.85%) of them have been found positive.
2. All 6 cases reported during the day are indigenous cases.
3. One death (Maharashtra) has been reported during the day.
4. * Major lab reports not received from the state.

Fig. 1.7. Status of influenza a(h1n1) in India as on april 11th, 2010 (source: mohfw website)

In the preparedness and response plan when India was affected, the Ministry of Health & Family Welfare strategized mass risk communication and media relations as essential part of the strategic approach. The communication need to be specific to the situation since even a few deaths in the initial clusters will create large scale panic. The communication should re-enforce actions to alleviate the fear among public. It should also be direct for the community to report immediately when they start showing symptoms. The non-pharmaceutical interventions also needed to be supported by a media campaign. At the grass root level, there should be social mobilization to sustain positive health seeking behavior. Effective risk communication, supported by confidence in government authorities and the reliability of their information, may help mitigate some of the social and economic disruption attributed to the pandemic. In this case this study helps to identify how effectively different health communication message has reached women in urban areas to give awareness and knowledge about swine flu. The influenced communication message would have brought some changes in the behaviors and practices among them by taking a preventive health measures.

Objectives

• To find the impact of health communication of swine flu among urban women community.
• To analyze the nature of the content of the persuasive messages by different communication campaign.
• To study the health communication theories and models
• To analyze theories and models of health communication with the effective communication strategy of swine flu campaign.

Review of Literature

Pandemics

Dumar (2009) defined that the word “pandemic” comes from the Greek (pan) meaning “all” and (demos) meaning “people”. It is an epidemic of infectious disease that spreads through population across a large region, for instance a continent, or even worldwide. According to the World Health Organization (WHO), a pandemic can start when three conditions have been met:

• Emergence of a disease new to a population.
• Agents infect humans, causing serious illness.
• Agents spread easily and sustainably among humans.

A disease or condition is not a pandemic merely because it is widespread or kills many people; it must also be infectious. For instance, cancer is responsible for many deaths but is not considered a pandemic, because the disease is not infectious or contagious.

Moeller (1999) states disease, especially epidemic disease is not only a biological phenomenon but a social, cultural and political one. How societies respond to catastrophic outbreaks of disease is measured by their level of emotion, their trust in science and medicine, their experience of pain and illness and their reaction to disability and death. The media’s greatest level of attention is reserved for epidemics that are novel, violent and intense and pose at least a perceived danger of breaking out of their bounds to threaten the nation. Therefore, in these instances, media audiences are especially dependant on the media as information sources and for guidelines about how to feel and how to react. Dramatic and tragic elements are emphasized by a focus on individuals and a more vivid use of language and metaphors. Although the outline of the media’s response to epidemic diseases remains remarkably constant among outbreaks, the tone of the coverage can vary.

Lemon and Hamburg (2007) state widespread media coverage of epidemics is hardly news and is an essential part of any epidemic. The media has the power both to inform and to misinform. Because the media powerfully shapes the public’s perception of an epidemic, the details of how popular communication is carried out are of utmost importance. Today’s coverage of pandemic events differs from previous eras in the technology, speed, and variety with which news reports are generated. In the early twentieth century, for instance, American consumers relied heavily on an extensive print media, whereas consumers today can turn to panoply of newspapers, magazines, television, radio, cable, Internet sites, Web logs and discussion groups. Nonetheless there is no question that the breadth of media genres–and the demographics of their consumers–is far greater today than in previous eras, and there is no doubt that the media has a far greater ability to provide consumers with both useful information and misinformation.

Blum and Knudson (2006) state "No one knows exactly how serious this threat could be. Nevertheless, we cannot afford to take a chance with the nation's health" with these words on March 24, 1976, President Gerald Ford launched one of the greatest debacles in public health history–the campaign to vaccinate every American against swine flu, the same virus that had swept the world in the great flu pandemic of 1918. The story splashed over the front page and dominated the nightly news on television. It transcended traditional beats - as all big public health stories do–and involved politics and economics as well as science and medicine. The swine flu story broke all the rules of conventional medical reporting and would forever change the way, public health is covered. Rubin and Hendy (1977) in their paper state that press coverage of the swine influenza inoculation campaign was generally superficial and marked by a "body count" mentality, but it was rarely inaccurate or sensational, as has frequently been assumed. A study of coverage in 19 daily newspapers, the three television networks, and a wire service shows that the best work was done by science and medical writers on major metropolitan newspapers. Television newsmen and wire reporters were unprepared for a story of such complexity. A weak press relations effort by the Center for Disease Control and other public health agencies contributed to the public's confusion and upset professionals in the press. A better understanding by doctors of how the press works and closer relations between the medical community and the press can improve coverage of future public health programs.

Health Communication

Rajan (2005) states that in the 1970's and 1980's, health beat consisted of regular assessment of the state public hospitals. Such scrutiny by the media put necessary pressure on these public institutions that are the lifeline for the poor in particular. Without the glare of media publicity, such institutions could literally get away with media publicity; such institutions could literally get away with murder. Today, instead, there are endless pieces on the new super-specialty hospitals, part of the growing, private health care sector. Such articles are usually prompted by public relations agencies hired by the hospitals to raise their profile in the city. But if new drugs or new technology related to heart diseases are available, even outside India, such news will be splashed all over the papers, often on the front page.

Atkins (2002) states a major player in the Indian press is The Times of India, which has expended from its western India origins to become a national force. It is considered trailblazer–albeit a sometimes ruthless one – in instilling an assembly-line mentality in the newsroom, it views stories as products and readers as consumers. In all fairness to the Indian press, many newspapers maintain a high standard of ethics and continue to do hard-hitting, socially relevant stories on child labour, women's health, education and other issues. An example is the coverage in mainstream newspapers of the continuing health problems related to the industrial disaster at the Union Carbide Corporation plant in Bhopal in 1984, an explosion and gas leak that killed more than 16,000 people. Still, these are the exceptions, not the rule.

Buresh and Gordon (2006) describe that today people have unprecedented access to research and other materials that used to be available only to health practitioners through newspapers, popular magazines, television news, or Internet sites. Studies suggest that many Americans rely on the media and the Internet as their primary sources of health information. As a National Health Council report put it, "The media have become an integral member of America's health care team". Many cultural, political, and economic factors have contributed to the media's unprecedented power to inform and influence people about their personal health and health care.

Aggarwal (2002) states that with the fragmentation of the media audiences into specialized target groups having their own specific agenda of uses and gratification from the media, the genre of journalism too has undergone subject specific-fragmentation. The growth of health-consciousness in the people of the developed world and disease-consciousness in the people of the developing world had spurred this Janus-faced process of fragmentation towards the evolution of medical/health journalism.

Boyce (2006) in his paper presents findings based on a media analysis of television, radio and newspapers, interviews with journalists and sources and the results of national surveys and focus groups with parents and uses a recent medical controversy in the UK as a backdrop to explore expertise. In 1998 a scientist claimed there might be a link between the measles, mumps and rubella vaccine and autism. His claims received significant media attention and vaccination rates fell across the UK. This case study examines how journalists constructed expertise, how key sources presented themselves as expert-sources and the effect of balancing expert-sources with sources.

Hinnant and Len-Rios (2009) in their research paper using interviews with 20 writers and editors for magazines and newspapers coupled with a national survey (N = 396), this analysis uncovers journalistic techniques and tacit theories for making information understandable. The journalists evince a basic understanding of how health literacy can be enhanced through certain story elements (such as nontechnical word use), but they also maintain false ideas about appropriate comprehension aides (such as statistics). Findings show that journalists struggle to maintain scientific credibility while accommodating different audience literacy levels. Journalists' definitions of health literacy strategically carve out a place for their work as translators.

Johnson (1998) states the impact of the media in supplying the public with health information, can be considered with the following results from a national poll of 2256 adults commissioned by the National Health Council.

1. Seventy-five per cent of those surveyed said they pay either a "moderate amount" (50%) or a "great deal" (25%) of attention to medical and health news reported by the media.
2. The primary sources of health news listed by respondents were television (40%), doctors (36%), magazines or journals (35%), and newspapers (16%). Interestingly, only 2% listed the Internet as a primary source.
3. Fifty-eight per cent said they have changed their behavior or taken some kind of action as a result of having read, seen, or heard a medical or health news story in the media. Forty-two per cent reported seeking further information as a result of media reports.

Levi (2001) in her book describes medical reporter influences awareness, attitudes and intentions but may also contribute to changes in behavior, health care utilization, clinical practices, and health policies. Media reports may influence what conditions are perceived as health problems requiring professional consultation and care. A systematic review of the best available scientific evidence in the field found that mass-media reports have a statistically significant and important impact on health services utilization. By featuring certain topics and excluding others, and choosing how to frame stories, the news media seem to not only reflect the public debate but also play an important part in setting the agenda, affecting public demand, and influencing the allocation of resources. In this respect, medical reporting is political.

Moeller (1999) states "Not since the Black Death has such mysterious evil visited England," noted Newsweek, referring to the announcement in late May 1994 that 11 people in Britain has died from a virulent strain of group A streptococcus. The American media's coverage of the "deadly bacteria" story bore all the stylistic hallmarks of their reporting on an outbreak of a deadly diseas– the story's format, language, metaphors and images–resonated with American cultural history, folktales and myths. Fearsome similes were employed as a measuring stick to gauge the new threat. A couple of weeks of terrifying coverage and the media is on to the next crisis. But the method of coverage sets the bar higher for the next incident, the method trains Americans to want ever more sensational details, the method prompts the media to consider covering only the most threatening, most aberrant, most contagious epidemics. Those illnesses which merely kill in some pedestrian fashion – like diarrhea or measles – will garner no attention at all, and become, ultimately, the causalities of compassion fatigue syndrome.

Reed (2001) in his paper states accurate, accessible and informative reporting is a major concern of all science journalists and scientists, although they are interpreted differently. The continuing conflicts and tensions are located in historically constructed occupational identities, particularly that of the scientist as 'modest witness'.

Shuchman (2002) states a 1997 survey of scientists found that the majority of them believed that reporters do not understand statistics well enough to explain new scientific findings, do not understand the nature of science and technology, and are more interested in sensationalism than in scientific truth. These concerns may have been bolstered by misleading reports in the popular press. Responsible reporting by journalists can illuminate important issues for the general public that might have otherwise remained obscured in the scientific arena. In some cases, investigative reporters have exposed aspects of medicine and medical science that prompted legislative and policy changes in the health care system.

Eggener (1998) in his paper states that there is a gap between the wealth of expanding information and the quality of public health, partly because of the difficulty of dispensing this information to the lay public. This ever-growing collection of information continues to influence the "wired" groups of society—the educated, wealthy, Generation X, and Baby Boomers—and has great potential for countless others.

Ransohoff and Ransohoff (2001) in their paper state sensationalism in medical reporting occurs when extravagant claims or interpretations about research findings are made. The conventional explanation for the problem is "miscommunication" resulting from the different styles of science and journalism, and the principal intervention proposed is "education."

Swine Flu

NDTV on April 29, 2009 reported according to the health ministry:

• A team of doctors and trained medical staff will be on standby at all the 9 airports

• Temporary quarantine areas are being set up inside the terminals where any suspect case can be isolated

• Along with the 24x7 call centers, they will take out ads in papers asking people to report any symptoms

In India the biggest challenge for the government right now is going to be preventing and tracking potential cases of swine flu entering the country through ports or international airports etc. But with lakhs of passengers coming into the country everyday screening each and every one of them is going to be quite a challenge.

The Hindu on January 25, 2010 in its article “Towards effective H1N1 vaccine” reported that the World Health Organization (WHO) is planning to review its response to H1N1 once the pandemic is over. Several European countries have accused it of exaggeration. The H1N1 flu virus began causing widespread outbreaks, but the pandemic turned out to be less of a killer than some virulent seasonal flu strains, people and governments are asking what the fuss was all about. The Parliamentary Assembly of the Council of Europe has now called for an investigation into the role of pharmaceutical companies in overplaying the dangers of H1N1.

The Hindu on January 2, 2010 in its article “Looking back on the pandemic” reported that 2009 saw the outbreak of a new influenza pandemic after an interval of 40 years. The first human cases appeared in April on the other side of the globe. Thereafter, in a world interconnected by rapid air travel, the new virus showed up in country after country. By June, the World Health Organization officially declared the start of the flu pandemic. The novel H1N1 strain has been quite unlike the one that set off the catastrophic 1918 pandemic.

The Hindu on December 22, 2009 in its article “Pandemic vaccine is safe” reported that the recent announcement by the World Health Organization that no serious and unexpected adverse effects have been seen in the nearly 65 million people who have been vaccinated for the 2009 influenza A(H1N1) in 16 countries is encouraging. The side effects -- swelling, redness, pain at the site of injection, fever, and headache -- were the common and anticipated ones; they resolved themselves spontaneously soon after vaccination.

The Economist on May 28, 2009 in its article “The origin of swine flu - Putting the pieces together” reported when a strain of influenza with pandemic potential struck in April, it was generally referred to as “swine flu” because it seemed similar to an existing group of strains, known as A/H1N1, which are commonly found in pigs. The World Health Organization and a number of European governments are now talking to manufacturers about expediting the development of such a vaccine and, on May 22nd, American officials announced a $1 billion scheme with the same goal.

The Economist on April 30, 2009 in its article “Pandemics - The pandemic threat” reported the new epidemic was raised on April 29th to just one notch below the level of a certified pandemic by the World Health Organization. In an effort to halt the spread of the disease, Mexico’s president, Felipe Calderón, has announced that non-essential services should close down between May 1st and 5th, and people should stay at home. But even if all the possible are counted in, a couple of hundred fatalities cannot compare with the 30,000 deaths caused in America each year by seasonal influenza. Either way, the authorities were right to hit red alert. Influenza pandemics seem to strike every few decades and to kill by the million—at least 1m in 1968; perhaps 100m in the “Spanish” flu of 1918-19.

Kapoor (2010) reports that The United States of America have been the worst hit during the Swine Flu pandemic. The threat of influenza is now being fought using the social networking medium to create more awareness about the vaccine. The Department of Health and Human Services (HHS) has initiated the campaign using a new Facebook application known as “I’m a Flu Fighter!” Basically this application will allow people to get an H1N1 vaccination and let others know that they are Flu Fighters now! An instinctive motive will urge others to follow their footsteps. Ben Reis, PhD, of the Children’s Hospital Informatics Program said, “By leveraging existing social connections, people can spread positive health behaviors and attitudes amongst their friends and loved ones.” On the Indian context, In.com, the portal from Network18 had launched a Swine Flu guide to serve as a reliable destination and keep the fatal disease away. This also helped pharma companies to reach their target audience and recommending the right vaccine through such platforms.

Kaul (2009) reports on his article “SMS GupShup Launches Swine Flu Community + Other Online Resources” that the social messaging platform, SMS Gupshup has established a community ‘SWINEFLU’. The community has over 2100 member now in less than a week and sends out daily messages which include preventive measures, symptoms, tests, resources and real time news to its subscribers. At the same time it tries to debunk myths and baseless rumors. Members usually receive one SMS a day.

Mercola (2010) reports on January 25 the Parliamentary Assembly of the Council of Europe (PACE) will launch an emergency inquiry regarding the influence of pharmaceutical companies on the global swine flu campaign. The inquiry will focus on the drug industry’s influence on the World Health Organization (WHO). The investigation is listed on the EU’s draft agenda as “Request for Debate Under Urgent Procedure on ‘Faked Pandemics – A Threat for Health’.” Finin (April,27 2009) reports on “Twitter Swine Flu news: the downside” while we can use Twitter for news or reports on unfolding events from the field, it’s a noisy channel. It seems that the flu-related tweets are arriving faster than anyone can read them.

WEBWIRE (January 24, 2010) published leading global market intelligence firm Synovate released data from a study examining the physician’s view of the recent Swine Flu pandemic. The survey, interviewed physicians from the UK, France, Germany, Italy, Spain, USA, China, Taiwan and India about their views of the subject, revealed some interesting findings. The Asian markets seemed to be the most satisfied with their governments’ reaction: 54% agreed that it has been well handled. In Europe, it is a rather different story with only 26% agreeing. Sixty-one % of all physicians surveyed felt or felt strongly that the media in their country has over-dramatized the swine flu outbreak. There were notable regional differences in opinion: 75% of respondents in the European markets agreed, 48% in Asia, and 46% in the US. Perhaps the most critical were the UK doctors with a huge proportion (82%) agreeing or strongly agreeing that the British media has over-dramatized the situation.

Research Methodology

The research method adopted for the study is survey method. This survey method helps to find the impact of health communication of swine flu among the target group especially women. This is purposive sampling method were the individual questionnaire is distributed to the respondents and collected. The sampling size of the survey is hundred. The samples are specified by the sex and educational status. The respondents are categorized into literate (fifty samples) and illiterate (fifty samples) women group for the survey.

From the results of the survey, the impact of health communication on swine flu is identified. The obtained results are comparatively analyzed with the theories and models of health communication to find the nature of the content of the persuasive messages by different communication campaign which tends to change their behavioral attitudes. And also helps to find the effectiveness of the communication among the women.

Findings and Discussions

The survey data are tabulated below to find the exact results. The different opinions from the literate and semi-literate group is collected and analyzed.

Awareness on swine flu

From the above arrived data it is understood that the 52% of the semi-illiterate groups have the awareness on what is swine flu and what disease is that? And nearly 48% of the same group had not much aware on swine flu. And 72% of the literate groups have awareness on swine flu and rest of the 28% of the respondents from the same group had not much aware on swine flu. It is understood that the environment for communicating about health issue has changed significantly due to the different status of the people including education and economic status. And moreover these changes also include by the dramatic increases in the number of communication channels and the number of health issues varying for public attention as well as people's demands for more and better quality health information. Communication occurs in a variety of contexts (for example, school, home, and work); through a variety of channels (for example, interpersonal, small group, organizational, community, and mass media) with a variety of messages; and for a variety of reasons. (Simons-Morton and Donohew et al, 1997). In such an environment, people do not pay attention to all communications they receive but selectively attend to and purposefully seek out information.

Awareness on swine flu vaccination

From the above arrived data it is understood that the 20% of the semi-illiterate groups have the awareness on swine flu vaccination and 80% of the same group had not much aware on swine flu vaccination. From the results it is able understand that the message on swine flu vaccination has not reached the semi-illiterate people. The form of message through different media communication has certain issues in communicating the illiterate group. And 76% of the literate groups have awareness on swine flu vaccination, in that almost 30% of the same respondents have vaccinated themselves and for their families, and 24% of the respondents from the same group had not much aware on swine flu vaccination. Clear communication and provision of updated information also helped to improve awareness and preparedness during the current pandemic (Harris, 1995)

Most useful medium in communicating information on swine flu

The collected data says that the most useful medium for receiving such information for semi-illiterate group is television medium which has 75% respondents and 13% goes to newspaper and 12% goes to radio medium whereas internet is not preferred by this group, though it targets most of the well educated people and other professionals. Among the literates 60% of the respondents prefer television medium and 15% newspaper and 5% radio and 20% preference to the internet for gaining information on swine flu. Health communication in particular media alone, however, cannot change systemic problems related to health, such as poverty, environmental degradation, or lack of access to health care, but comprehensive health communication programs should include a systematic exploration of all the factors that contribute to health and the strategies that could be used to influence these factors through different accessible medium. Increasingly, health improvement activities are taking advantage of digital technologies, such as telemedicine, internet and mobile communication engage people in interactive, exchange communication instantly. (street and Manning. et al, 1997). Despite the preference of media differs due to accessibility, affordability and educational status.

Persuasive messages helped to take any preventive measures

The data from the survey results that, 70% of the semi-illiterate group agreed that these communication message from the powerful medium influence to take preventive health measures on swine flu, only 30% of the respondents disagreed and said that these communicating message create distrustfulness. Sometimes susceptible health communication through media may not be believed by the people. The same way the literate group also responds to the question. Successful health promotion efforts increasingly rely on multidimensional interventions to reach diverse audiences about complex health concerns, and communication is integrated from the beginning with other components, such as community-based programs, policy changes, and improvements in services and the health delivery system. (Simons-Morton, Donohew, and Crump. et al., 1997).

Analysis on theories of health communication impacts on behavior and practice

Over the decades the social scientists have advanced various theories of how communication can influence human's mind and bring changes in the behavior. The various theories and models provide communicators with indicators and examples of what influences behavior, and offer foundations for strategic planning, executing, and evaluating communication development (Piotrow and Kincaid. Et al., 1997), especially theories relevant to health communication include the following:

Protection Motivation Theory explains the influencing and predicting behavior of the communicated people. According to the persuasive communication by the media, the information about the disease created the pandemic among the people with an emphasis on the reach of information. This created a threat among the people with the cognitive processes of mediating behavioral change.

According to the theory, persuasive message on awareness of swine flu vaccination through television and print media reached the people with different perceptions towards the message. This leads to the response efficacy of the individual's expectancy that carrying out recommendations can remove the threat. Self-efficacy is the belief in one's ability to execute the recommend courses of action successfully. Hence the protection motivation is a mediating variable aroused the literate group to vaccinate, sustain and direct to protective health behavior, whereas the same message have not created much persuasiveness among the semi-literate group to vaccinate. (Boer, Seydel, 1996)

According to Roger E, 1975, Diffusion of Innovations Theory traces the process by which a new idea or practice is communicated through certain channels over time among members of a social system. The model describes the factors that influence people's thoughts and actions and the process of adopting a new technology or idea (Rogers, 1962, 1983). In this way communication on swine flu literally intrude to people's mind to react towards the preventive measures of the disease. The digital media and technology plays a major role in immediacy of communication targeting all segment of people.

Health Belief Model explains the health behaviors of the targets. The Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviors. This is done by focusing on the attitudes and beliefs of individuals towards the message on swine flu vaccination and health cause of the disease among the respondents of the survey. The model is based on the understanding that a person will take a health-related action like having vaccination for the swine flu, and thus it has a positive expectation that by taking a recommended action, respondent will avoid a negative health and believes that respondent can successfully take a recommended health action .(Glanz et al, 2002)

The Input/Output Persuasion Model (McGuire, 1969) emphasizes the hierarchy of communication effects and considers how various aspects of communication, such as message design, source, and channel, as well as audience characteristics, influence the behavioral outcome of communication (McGuire, 1969, 1989). In this the communication on swine flu influence the people by the message as wear face mask, close your mouth and nose while coughing and sneezing, medium source like television has attracted the audience with best advertisements on swine flu and news coverage.

Social Cognitive Theory explains the behavioral patterns of the people in the society. The Social Cognitive Theory is relevant to health communication. The social cognitive theory explains how people acquire and maintain certain behavioral patterns, while also providing the basis for intervention strategies (Bandura, 1997). Evaluating behavioral change depends on the factors environment, people and behavior. The situation refers to the cognitive or mental representations of the environment that may affect a person's behavior. The situation is a person's perception of the lace, time, physical features and activity (Glanz et al, 2002). The three factors environment, people and behavior are constantly influencing each other.

That adoption of a behavior is a function of intent, which is determined by a person's attitude (beliefs and expected values) toward performing the behavior and by perceived social norms (importance and perception that others assign the behavior). Social cognitive (learning) theory, by A. Bandura, specifies that audience members identify with attractive characters in the mass media especially they understand the target audience, it is differentiated with the style and format of the program content, like that who demonstrate behavior, engage emotions, and facilitate mental rehearsal and modeling of new behavior. For example, the television advertisement on swine flu communicates the message like people have to approach government health centers for check up and do test and take preventive measures, the visuals of a blind man going for the check up approaching the government health care centre and people of everybody includes other patients, nurses and doctors etc., applause the blind man this creates a visual appealing and emotional situation. The behavior of models in the mass media also offers vicarious reinforcement to motivate audience members' adoption of the same behavior (Bandura, 1977, 1986).

Social Process Theories: Social influence, social comparison, and convergence theories specify that one's perception and behavior are influenced by the perceptions and behavior of members of groups to which one belongs and by members of one's personal networks. People rely on the opinions of others, especially when a situation is highly uncertain or ambiguous and when no objective evidence is readily available. Social influence can have vicarious effects on audiences by depicting in television and radio programs the process of change and eventual conversion of behavior (Festinger, 1954; Kincaid, 1987)

Cultivation theory of mass media, proposed by George Gerbner, specifies that repeated, intense exposure to deviant definitions of "reality" in the mass media leads to perception of that "reality" as normal. The result is a social legitimization of the "reality" depicted in the mass media, which can influence behavior (Gerbner, 1973, 1977; Gerbner et al., 1980). Similarly people believe in television news and advertisements and announcements related to health communication. The credibility of the news in the channels brings the reality by the visuals and content of the coverage and the program.

Conclusion

Effective health communication is now recognized to be a critical aspect of healthcare at both the individual and wider public level. Good communication is associated with positive health outcomes, whereas poor communication is associated with a number of negative outcomes. Knowledge is a significant influence on attitudes and practices in a pandemic, and personal experience influences practice behaviors. Efforts should be targeted at educating the general population to improve practices in the current pandemic, as well as for future epidemics.

The study provides evidence on the correlation between knowledge, attitudes, and practices among two different exposure groups with similar health communication on swine flu. This has substantial implications for public health educators and planners in implementing pandemic preparedness plans. This shows that good knowledge is important to enable individuals to have better attitudes and practices in influenza risk reduction. (Maibach and Parrott, 1995).

Healthcare workers and communicators, educationist have had greater and more direct exposure to flu cases compared to the general population and this first-hand experience may have resulted in behavioral changes. This possibly reflects the effect of actual real-life experiences with flu on individual behavior among the literate group. It will therefore be important to determine solutions to instill the same level of positive behaviors in the general population like to illiterates and semi-literates without the need for prior infection or the personal experience such as being close contacts or healthcare workers. One possible solution would be the sharing and imparting of personal experiences to the general community through effective communication strategy with greater health messages in most accessible medium of channel. Theories and models of health communication define the communication process and strategic ideas of communication by defining the health messages. The content of the media differs according to the genre of the media. It's the prime duty of the media to educate the masses and help them to take informed decisions especially when it comes to health related issues.

Suggestions

The media should be self-regulatory and set itself a set of guidelines and standards to report health related issues. Media should understand its commitments to the society in times of such global pandemic crisis, as it serves as a primary source of information worldwide. It has to refrain from reporting sensationalized news stories, making public service announcement, forming communication content and employ more information value and elements of awareness in its health related articles. It can publish expert's views columns and more health features to dispel the public on myths and misconceptions of a disease. Media should make a responsible choice between spreading the word of caution, saving lives across the globe or instilling fear and panic victimizing the citizens.

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Museums for Biodiversity Conservation and Environment Education

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Abstract. Public consciousness about biodiversity and the environment, and their importance for sustainable development is not so widespread in India. This article focuses on non formal environment education through nature interpretation centres and science museums. Information is provided about the potentiality of museums in providing recreation-cum-education to the general people and children. Some universities have small museums, botanical gardens, and other biodiversity exhibits for instruction and research, but these and the few zoos and wildlife centers are poorly funded or managed.Environmental problems like pollution, population explosion, deforestation, natural calamities, destruction and poaching of wildlife, overuse of pesticides all need serious attention. People are generally unaware of the importance and significance of the surrounding environment due to illiteracy and lack of education. For school children, Environmental Education has been regarded as a compulsory subject uptil the senior level. Even Environmental Education is a subject of Graduation. But it is doubtful whether the students are really learning to protect the environment and work for its preservation or just learning it by heart to score in their exams. So, theoretical learning is not at all fruitful until supplemented by use of all five senses. In the context of globalization and rapid advancement of technological arena, Museums should take the challenge of preserving the environment. Creating Environmental awareness will not only be beneficial for the society, but at the same time museum will too be benefited. For environmental degradation in form of pollution is harmful for museum buildings and objects. Environmental education seeks to empower individuals with an understanding of environmental problems and the skills to solve them. Besides the traditional role of documenting and displaying, educational programmes, a Science Museum and Natural History Museum can take up challenges of implementing and inculcating the environment awareness to all target groups.

Keywords: Biodiversity, Conservation, Environment Education, Interpretation centre, Sundarban,

Introduction

Plant and wildlife resources are of great economic as well as ecological importance. Each species is unique and irreplaceable. Every species is of scientific interest and makes some contribution to its ecosystem. However millions of species are disappearing from our earth. In the recent time, the rate of species extinction has gone up alarmingly high and is a matter of great concern. Taking into account the fast disappearance of Biological species, the year 2010 has been designated the International Year of Biodiversity by United Nations General Assembly so as to send the message of the need of Biodiversity conservation in a global perspective.

In today's world, the "natural habitat" of people has become the built environment where children spend on average 90% of their time (*Stephen Kellert, Yale School of Forestry,* Lecture in the San Diego Natural History Museum). So strategies need to be developed for a strong connection between the natural and built environments.

Many attempts have been made to bridge the gap between nature and layman. Attempts have been made through books, magazines, television programmes and school curricula. But such attempts will not be fruitful unless the theoretical knowledge are supplemenred by props- that is interactive way by which people can make themselves feel to be a part of the surrounding environment. There is need for an environment in which people can become familiar with the details of biological diversity and environment and gain some understanding by watching nature and various plant and animals behaviours.(*Frank Oppenheimer-University of Colorado, November 196*8).

Of the different types of Science museums, Nature Interpretation Centres can form a strong link in connecting nature with man. Interpretation Centers are buildings generally located at the place of interest that is an ecologically rich zone, nature reserve, etc. for dissemination of knowledge and information of the site through different exhibits. They are specialized for communicating the significance and meaning of natural or cultural heritage and serve for education and awareness. Visitors or tourists need to consider the visit to the interpretation centre as a part of their work before visiting the respective ecologically important site. The Environmental Committee of the American association of Museum, 1971 states: “Museums have seldom applied their influence to public issues: but the time has come when these institutions, which through the years have preserved man’s treasures and nourished his spirit, must also apply themselves to the preservation of an environment fit for life”. One of the thrust areas that pose a challenge to museologists is Environment. Presently, there is a growing concern throughout the world about the alarming condition of our environment.

Objectives

The present paper elaborates on the role of some Interpretation centres within West Bengal, India and how they communicate the importance of biodiversity conservation. The museums or Interpretation Centres under survey centres on the existing biodiversity of Sundarban National Park, 24 Pgs (S), West Bengal. The rate of biodiversity loss is increasing and we need to act now to significantly reduce it and remove this global extinction crisis. Our lives are inextricably linked with biodiversity and environment and ultimately its protection is essential for our own survival.

Area of study

The Sundarban comprising the largest mangrove cover in the world and Bengal’s only Natural Heritage Site (as recognized by UNESCO) boasts of its importance in sheltering some of the endangered and critically endangered animals of the world. The Estuarine crocodile (*Crocodylus porosus* Schneider), forming the topmost consumer of the Aquatic Food Chain of the Mangrove ecosystem is one of such endangered reptiles. But in the recent past, the number of naturally reared crocodiles has decreased in number. Estuarine crocodiles form a very important part of the mangrove ecosystem. Any decline in the Crocodile population can cause tremendous impact on the primary and secondary consumers of the Mangrove ecosystem.

So, in order to restore the crocodile population, Forest Department of West Bengal has initiated a site for Breeding and rearing of these majestic estuarine reptiles in captivity at Bhagabatpur, 24 Parganas (S), followed by the release of the matured crocodiles back into their natural habitat, i.e. the tidal creeks of Sundarban. If one takes the chance of visiting the site, he or she may be able to get a clear idea about the birth and nurturing of baby crocodiles, their food habits, their gaining of maturity and final release into the estuaries. To supplement the living reptiles, an Interpretation Centre has been set up adjacent to the Breeding site. Visitors visiting this site should feel fortunate to come across such an informative resource centre. Within the Bhagabatpur Crocodile Breeding Project, an interpretation centre had been established adjacent to the breeding zone for creating awareness on crocodiles and floral and faunal heritage of Sundarban.

Methodology

Other museums involving Sundarbans include the Nature interpretation centres at other islands of Sundarbans which include Bonnie Camp, Ajmalmari Block, Sajnekhali and Bhagbatpur. Field visits were made and various literatures were consulted and correspondences with Forest Department made to gather information about the various activities of the Museum.

The data collected through the questionnaires were supplemented with additional data from semi structured interviews conducted immediately after the visit. Comparison was made with other leading Natural History museums in India.

Observations

The following observations were made during visit and survey of Bhagabatpur Interpretation Centre, Sundarban, 24 Pgs (S).

The entry point to the Breeding Project area bears some of the notable signage as mentioned below:

1. List of common flora in the Protected Areas, i.e. Lothian and Haliday Wildlife Sanctuaries of Sundarban. This includes true mangroves, mangrove associates, back mangroves as well as a few associated non-mangroves, thus highlighting the floral heritage of Sundarban.

2. A display board mentioning about the Do-s and Don't-s for the visitors. The instructions are written both in local language, ie. Bengali as well as English and clearly makes even a layman aware of the basic rules that are to be maintained within the breeding project area.
3. One of the Display board requests the visitors to pay a visit to the Interpretation Centre, at the entrance of breeding place for information on wildlife. So from the entry point itself, an indication is there to pay a visit to the Interpretation Centre suggesting there might be something valuable to gain from the Centre.
4. Request to the visitors to sign in and leave their comments in the Visitor Register. This is very important for it is an aid through which the authorities can evaluate the effectiveness of their communication and awareness on the heritage of Sundarban.

The dense growth of some mangrove species like Garjan (*Rhizophora mucronata*), Gneoa (*Excoecaria agallocha*), Kankra (*Brugueira gymnorrhiza*), *Avicennia* sp., Hental (*Phoenix paludosa*), Golpata (*Nypa fruticans*), Heritiera fomes (Sundari), Hargoja (*Acanthus ilicifolius*), Nona jhau (*Tamarix dioica*) and the mangrove fern *Acrostichum aureum* (Hudo) surrounding the breeding project as well as the Interpretation Centre are a feast to every visitor's eyes.

Near the entry point of the Interpretation Centre, there are display boards portraying the following themes:

1. World distribution of Crocodile, Alligator, Caiman & Gharial- which gives an impression of the distribution pattern and types of crocodiles across the world including the number of species.
2. Another interesting display is the "Salient features of Estuarine crocodiles". This indeed gives an overall impression regarding the external or identifying features by which we can identify an estuarine crocodile from other members like gharial and alligator. So one can note down the characteristic features and compare them with the live specimens. This will increase their power of observation of the morphological features of the crocodile hatchlings, which they could have missed had they seen the hatchlings without noticing the display board.
3. One display board gives an idea of the overall captive breeding procedure by means of flowcharts.
4. Once again, the ways of alerting people about the do's and don'ts of visiting the breeding centre is highlighted in a very lucid way.
5. The colorful pictorial depiction of the Food web prevalent in the mangrove ecosystem where crocodile forms the topmost of the food chain is of special interest to children and students.
6. A statistics of the success of the breeding of Estuarine crocodile in Bhagabatpur and around the world have also being displayed.

Display Technique of exhibits within interpretation centre

The Interpretation centre comprises of a large single Hall displaying various exhibits and specimens as listed below:

1. ***Preserved Specimens***: As one crosses the entrance, he or she will inevitably be attracted towards the different stages of crocodile hatchlings starting from the large ovoid creamish white eggs. The eggs and crocodile hatchlings have been preserved within a chemical preservative-Formaldehyde. The labeled jars are kept at different levels for better viewing by the visitors.
2. ***Model***: To notify the location of the island and the Breeding Project in particular, a 3D Model of the map of Sundarban have been kept well lighted.
3. ***Photographs*****:**

- The entire wall displays a large number of enlarged photographs on different stages of capturing of the mature crocodiles from breeding centres and their release into the various tidal creeks of Sundarban.
- (Besides the estuarine crocodiles the floral and avi-faunal diversity of Sundarban have been portrayed through such enlarged photographs.
- Enlarged photographs of general themes such as honey collection, fishing, agriculture, prawn seed collection also add to the display. Thus the socio-economic aspects of Sundarban have also been portrayed.

4. ***Laminated posters*****:** Enlarged laminated illustrated posters on important flora and fauna of Sundarban, List of endangered, rare

and extinct fauna of Sundarban, Prey species of Sundarban tiger and Ecodevelopment activities have been portrayed.

5. ***Sketches:*** Black and white labeled sketches showing distinguishing features of tongues of estuarine crocodile, marsh crocodile and alligator forms an added attraction.
6. ***Charts:*** A chart displaying the origin and evolution of reptiles is very interesting as well as informative
7. ***Map:*** A map portraying the wildlife of India is a source of added information to all types of visitors, especially wildlife lovers.

Analysis

Till date, various local schools, including a Blind Boys school have visited the interpretation centre and have immensely enjoyed their visit as evident from their remark on the Visitor Register. Research scholars from different universities visit the Breeding Centre quite often. General visitors, tourists and foreigners throng the breeding centre during the pleasant winter season. Tourists from Lucknow, Germany, Spain, Canada, and U.S.A have visited the entire complex, i.e. breeding site as well as the Interpretation Centre.

The Interpretation Centre at Bhagabatpur has thus being quite successful in reaching out to people, not only regional, but also at global level. However, more of publicity through educational awareness programmes, outreach programmes and most importantly developing popular as well as some scholarly publications will definitely enhance its success rate. Setting up of such a valuable Interpretation Centre in the rural area of Bhagabatpur, taking into consideration the dependence on solar power and adverse climatic conditions is indeed praiseworthy. Visitors will be enriched about not only the endangered crocodiles, but other important flora, fauna of the mangrove ecosystem.

Conclusion

Thus, it is seen that a Nature Interpretation Centre should not only highlight environment through its exhibits, but also device different communication techniques, which preferably centres on burning issues of today. In the fast changing world, where environment is at stake, a museum professional should rightfully consider Environmental degradation as an issue to be given due importance through the public. According to the keynote address delivered by Director General, Natural History Museum, Vienna, at NATHIST meeting, 20th August 2007, "*… the major concern of the museum of Natural History is to take care that nature will not become history. Busier than ever all museums are collecting, conserving and defending cultural and natural values on an overpopulated planet, where the human race is to be blamed for mass-extinction of plants and animals, the rate speeding up to a thousand times the natural extinction rate in evolution….*" So, environment awareness and conservation of Biodiversity is one of the challenges to be taken up by Nature Interpretation Centres to prevent nature turning into history.

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The Analysis Study of Chinese Public Attitudes Towards Science and Technology from 2010 Civic Scientific Literacy Survey in China

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Abstract. China Association for Science and Technology launched 8th Chinese civic scientific literacy survey, which was the largest survey in history with the sample size of 68416. The survey measured the Chinese public attitude towards science and technology through a battery of statements on science, technology and environment to which respondents were asked if they agreed or disagreed. The purpose of this paper was to investigate the Chinese public attitudes towards science and technology. Through the data analysis we obtained the status of Chinese public attitudes towards S&T and came up with suggestions on how to promote the public having the correct image of science and technology.

The findings of the study are: (1) Most of the Chinese citizens keep a positive attitude towards science and technology. The views of Chinese on the wider effect of science and technology on society are also positive especially the effect of science and technology on the work and human health. (2) Most of the Chinese citizens show their support to basic scientific research and they agree that scientists should participate in science communication to get people to know more about the new development of science research. About experiment animals, more than a half of the respondents in China agree that scientists can be allowed to use animals to do experiments like dogs and monkeys if they can produce new information about serious human health problems. (3) When asked about the effect of science and technology on environment, we find a public divide in attitudes held by Chinese citizens. (4) The opinions of Chinese citizens and EU citizens differ greatly. Chinese citizens hold more positive attitudes than the European citizens towards S&T. (5) Highly educated citizens have clearer cognition about the benefits and limitations of science and technology on human beings and society comparing to lowly educated citizens, and also are more rational. (6) We should put more efforts to investigate the factors affecting the attitudes towards science and technology and to improve the public science literacy.

Keywords: Attitudes, science and technology, scientific literacy survey

Introduction

The 8th Chinese Public Attitudes towards Science and Technology survey was accomplished by China Association for Science and Technology recently in 2010. China had its first survey of the sort in 1992 and the target citizenry was framed ever since at an age range between 18 and 69 in mainland China. Abundant data and research results were obtained during the last 18 years. Questionnaires used in the subsequent surveys were progressively amended by taking into consideration of both the international common items and the Chinese characteristic context.

Methods

The sampling size of the 8th survey hit 69, 360, and 68,416 valid responses were eventually collected, being the largest one ever known. Stratified three-staged PPS non-random method was adopted in sampling process, and visits of respondents were performed through indoor interviews. The obtained data was processed via multivariable non-linear joint weighted method. Gender, age, education and rural or urban are the four statistic variables involved in data processing. The survey measured the Chinese public attitude towards science and technology through a battery of statements on science, technology and environment to which respondents were asked if they agreed or disagreed. The purpose of this paper was to investigate the Chinese public attitudes towards science and technology. Through the data analysis we obtained the status of Chinese public attitudes towards S&T and came up with suggestions on how to promote the public having the correct image of science and technology.

Results and discussions

Most of the Chinese citizens keep a positive attitude towards science and technology. When asked whether Science and technology make our lives healthier, easier and more comfortable, 89% of Chinese agree. There are 78% of Chinese citizens who agree that scientific and technological development will create more jobs than they will eliminate. They also in majority feel positively that thanks to science and technology there will be more opportunities for future generations (85%). The views of Chinese on the wider effect of science and technology on society are also positive especially the effect of science and technology on the work and human health. About the effect of science on people's health, there are 77% of Chinese citizens agreeing that scientific and technological progress will help to cure illnesses such as AIDS cancer. 75% of respondents agree that the benefits of science are greater than any harmful effects it may have. From this we can see that most of Chinese public feel positively to the science.

Chinese public hold positive and supportive attitude towards scientific and technological research. Most of the Chinese citizens show their support to basic scientific research and they agree that scientists should participate in science communication to get people to know more about the new development of science research. About experiment animals, more than a half of the respondents in China agree that scientists can be allowed to use animals to do experiments like dogs and monkeys if they can produce new information about serious human health problems. Most of Chinese agree that scientists should participate in science communication to get people know more about the new development of science research (75%). Majority of respondents support the scientific research even if it brings no immediate benefits (71%). About the animals experiment, 63% of Chinese citizens agree that scientists should be allowed to do research that causes pain and injury to animals like dogs and monkeys if it can produce new information about serious human health problems, while 44% of EU respondents agree with the statement. As a whole, we can see that Chinese citizens keep supportive to science research.

When asked about the effect of science and technology on environment, we find a public divide in attitudes held by Chinese citizens. When asked whether technological discoveries will eventually destroy the earth, 23% of Chinese agree, 35% of respondents disagree. It should be concerned that there are 23% of respondents said that they don't know about the point and about 20% of respondents report that neither agree nor disagree. 36% of Chinese citizens do not agree that science and technology advances will allow the Earth's natural resources will be inexhaustible. Only 28% of respondents agree with the statement.

Most of the Chinese public hold rational attitude towards science and technology development. Nearly one third of Chinese respondents (32.7%) totally agree that' the benefits of science are greater than any harmful effects it may have', and 42.1% of respondents tend to agree. Concerning the impact that science and technology may bring to environment, more than a half of respondents (57.2%) believe that' technology application will have both positive and negative effect on environment'. A small number of Chinese public have over-positive attitude to science and technology development. Most Chinese citizens do not agree that 'science and technology will make the Earth's natural resources to be inexhaustible'. Only 13.4% of respondents agree with the statement. Few Chinese respondents hold negative attitudes to science and technology development. Less than one tenth of respondents (8.0%) totally agree with the statement that 'constant application of technology will eventually destroy the earth'. Only 5.4% of respondents totally agree that 'even without S&T, people can live very well'. (Figure 1)

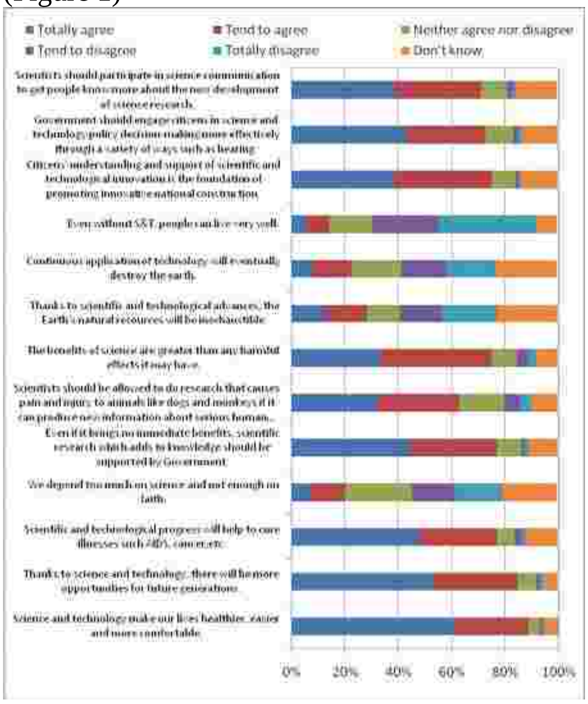

Figure 1. Chinese public attitudes towards science and technology

Conclusions

From above findings, we can make conclusions: (1) Most of the Chinese citizens keep a positive attitude towards science and technology. The views of Chinese on the wider effect of science and technology on society are also positive especially the effect of science and technology on the work and human health. (2) Most of the Chinese citizens show their support to basic scientific research and they agree that scientists should participate in science communication to get people to know more about the new development of science research. About experiment animals, more than a half of the respondents in China agree that scientists can be allowed to use animals to do experiments like dogs and monkeys if they can produce new information about serious human health problems. (3) When asked about the effect of science and technology on environment, we find a public divide in attitudes held by Chinese citizens. (4) The opinions of Chinese citizens and EU citizens differ greatly. Chinese citizens hold more positive attitudes than the European citizens towards S&T. (5) Highly educated citizens have clearer cognition about the benefits and limitations of science and technology on human beings and society comparing to lowly educated citizens, and also are more rational. (6) We should put more efforts to investigate the factors affecting the attitudes towards science and technology and to improve the public science literacy.

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Do Science Communication University Programs Equip Students to Become Professionals? A Comparison of 20 University Programs Worldwide

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Abstract. During the 10th International PCST conference in 2008 the states of science communication curriculum worldwide was one of the items in a workshop on science communication curricula. However, there remains much to be explored and discussed, especially how science communication programs present to potential students the relation between the curriculum and profiles of science communicators. In this research, twenty science communication master programs worldwide are investigated and compared for a better understanding of how the curriculum equip students to become professionals.

Keywords: Profiles, Science communication curriculum, Professionals, University programs

Introduction

Science communication is a new and emerging discipline. In *Science Communication, an emerging discipline* (Trench, Bucchi, 2010), one of the conditions mentioned for an established discipline is a bounded field of study with significant presence in teaching and research in the higher education sector. Science communication is a field of study that has been growing and developing over the last 20-30 years, integrating professional activities and established studies, for example disciplines such as science education, social studies of science, mass communication, and museology, etc. Simultaneously, the specialization of science communication professional is also growing. For a multi-disciplinary and interdisciplinary discipline, organizing the core knowledge for the study would be challenging (Priest, 2010). In Mulder's model (Mulder *et al*, 2008), the four areas of study in science communication are defined: *science*, *social studies of science*, *communication studies* and *educational studies*. There is already a lot of existing science communication programs worldwide with very different program objectives, curricular structures, and descriptions of the profiles of science communicators. This makes it very hard for potential students to grasp how the structure and content of the curriculum relate to the professionalism of science communication. Although university master programs do not aim at vocational trainings, it is still very important for the students to see in which aspects the curriculum prepare and equip them to become future professionals.

By taking twenty science communication university master programs worldwide as examples to provide a descriptive current overview, the main research question asked in this paper is: Do science communication university master programs equip students to become professionals? Two sub-questions are also proposed: How are the program objectives related to the profiles of science communicators? How are the programs structured to equip students to become professionals by relating the content of the study to the profiles?

Methods

The research is based on online information from twenty science communication university master programs worldwide, including 3 programs from the Netherlands, 3 from the United States, 2 from England, 2 programs from Australia, 1 from Brazil, Canada, France, Italy, Ireland, Japan, Korea, Mexico, New Zealand, and Spain. The programs are chosen from different countries to present the worldwide overview. Accessibility and availability to the websites of the programs are also prerequisite for choosing the programs. Three steps are taken to conduct the research:

Step1: Data collection

Descriptions of the profiles of science communicators and other general information provided on the websites are collected to get an overview of the current status of science communication university master programs worldwide.

Step2: Categorizing

The lists of courses in each program are categorized into the four areas of study for science communication (Mulder *et al*, 2008): *science*, *educational studies*, *science and technology studies*, and *communication studies*. In this research, subcategories are made in each study to get a clearer view on the detailed contents of the curriculum and on subjects which are the main focuses in each area of study. For the area of '*science*', it is divided into two parts. The 'hard science' indicates courses such as natural science or engineering subjects. 'Science as contents' indicates that the course is designed to integrate scientific issues into the other three areas of study. For *communication studies*, three subcategories are made, with focuses on media skills, design or media studies. In the area of *social studies of science*, subjects such as history of science, societal and technological issues, philosophy of science, ethics, and science policy belongs to this part. For *educational studies*, courses that aim at informal learning, psychology, or didactics fall into the category. The internships and research projects in the programs are also analyzed by looking into the contents.

Step3: Linking the science communication curriculum with profiles

The last step tries to connect and compare the information gathered in step one and two to investigate the relations between the curriculum and profiles of science communicators. The model of professional positions and the corresponding areas of science communication study is applied (Mulder *et al*, 2008) to investigate the link. The profiles of science communicators are portrayed by the combinations from the four areas of science communication study, as shown in figure 1.

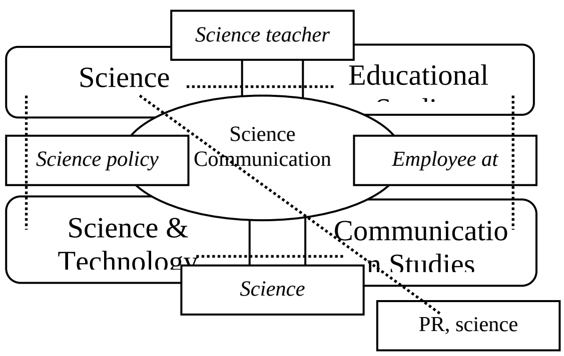


Fig. 1 Professional positions and the corresponding areas of science communication study

Results

The Objectives of the Programs

There are some similarities in the objectives of the programs, in which the importance of integrating theory and practice are stressed, and also the goal for students to gain competences in developing communication strategies, application of media in the social context. However, there are more differences than similarities in the objectives. Some programs aim at more specific objectives or USPs (unique selling point). For example, in Brazil, State University of Campinas, the main objective is to train researchers and journalists who are able to dedicate themselves to a more in-depth study of scientific and cultural communication. In New Zealand, University of Otago, the focus is on popularizing science: making science fun, sexy and easy to understand. University Pompeu Fabra in Spain organizes the curriculum in three modules: scientific communication, medical communication, and environmental communication, and the science communication program at Drexel University in the United States targets students who aspire to medical, science and pharmaceutical writing.

Professional profiles

Most programs provide descriptions of possible future science communication careers on their websites but only give a general list of the professionals. The most mentioned ones are communicators at science centers, PR, science journalists, science policy advisors, consultants, etc. Some programs give a more detailed description of the professionals. TU Delft in the Netherlands lists the career prospects for science communicators in six different positions by giving examples of the activities performed. In the description of 'science communication manager', it states that "communication managers are charged with the control, direction and coordination of the communication processes within and from companies and organizations." Also, some programs have different ideas about categorizing the profiles.

Background of the students

Only 7 out of 20 programs require students with a bachelor degree in science/engineering while the rest target student from both natural and social sciences. A few programs also include professionals, for example, in Brazil, State University of Campinas, students come from different academic trainings, including graduates, senior professors, engineers, journalists, natural and social scientists. In Japan, the science communication program in collaboration with CoSTEP at University of Hokkaido aims at training students as well as personnel.

Length of the Programs

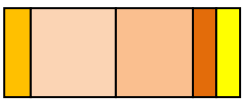
Ten programs are one year programs while the rest are two year in length. Four out of twenty programs provide students the possibility to conduct a part-time study.

The four areas of science communication study

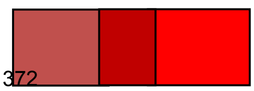
Each program contains at least two areas of science communication studies, mostly a combination of communication studies and social studies of science. In the category of *'science'*, most courses fall into the part of 'science as contents', for example: health care communication, energy communication, environmental communication, medicine and society, etc. Less than 20% of the programs have courses regarding the 'hard science' study, except the programs in the Netherlands which require students to participate courses in science/engineering discipline at master level and at Trieste University, Italy, where four areas of scientific studies are addressed: neuroscience, biology, environment, and mathematical physics. For the area of *communication studies* the focus on media skills and media studies are relatively higher than design courses. In social studies of science most courses are related to science and society. Only five programs have courses on *educational studies*, with focus on informal learning. Also, some parts of the curriculum fall out of the four areas of study, for example research methodology, research project, thesis, colloquium, workshop, intern, etc.

Science (15%), Educational Studies (10%), Science & Technology (25%), Communication Studies (50%)

Hard science (20%), Science as content (80%)



History (15%), Society (35%), Philosophy (30%), Ethics (10%), Policy (10%)



Media skills (40%), Design (20%), Media studies (40%)

Figure 2 shows the overview of the relative percentage of the four areas of study, and also the subcategories made from each area of study in this research. The overview of the four areas of study shows that science and educational studies only take up small parts, while the other two constitute most of the curriculum. The subcategories and their relative percentage also indicate the amount of focus given to each of the subjects.

Fig. 2 Relative percentage of the areas of science communication study

Internships and thesis/research projects

Due to the scope and limitation of accessibility to information, in this research only the internships and thesis/research projects are taken as examples to see how they are structured in length and content.

For the information accessible on internships, 13 out of the 20 programs require students to do internships. The lengths of the internships range from 4-6 weeks to 6 months. The places where the students can conduct their interns also vary. For example, in Canada, University of Laurentienne, students are asked to conduct internships at science-based organizations. In England, Imperial College London and TU Delft in the Netherlands, students have the opportunities to work at science communication organizations. In Italy, Trieste University, editorial offices, press agencies, museums, publishers, companies, research institutions are places where students can conduct their internships. At Dublin City University in Ireland, a work placement during summer or May-September period is offered. The two programs in the United States have more specific internships, at science and health organizations (Florida University), and part-time interns (2 days/week) throughout the academic year at local news organizations (University California, Santa Cruz).

For the programs which require the students to do a thesis/research within the length of the study, they could be done within an organization as a practical, work-based research (as work-placement), or be carried out as a theoretical and research-based project. The percentages also differ from program to program, ranging from zero to approximately one-third of the whole study period.

Objectives, general information and professional profiles

In general the objectives of the programs are very vague and do not state clearly the profiles of science communicators. However, for those who mention unique selling points in the programs, the goals of the programs match more with the profiles. For example, in Brazil, University Campinas, the USP is related to the 'professional profile' of 'scientific and cultural communication'. In Canada, University of Laurentienne, the modules aimed at practical skills is related to the tasks of 'officers at science center' in the profile. At TU Delft in the Netherlands, the curriculum is organized to fit with the professional positions mentioned in the career prospects.

Objectives, profiles and the curriculum

According to the Mulder model the four areas of science communication study relate to the profiles of the professionals based on combinations of different studies. By cross-comparing the objectives, profiles and curriculum in each program, it is clear that most of the curriculum fits into the profiles and objectives. For example, University of West Australia describes the objectives as "cultivation of students for developing the practical skills and design strategies for the communication needs of groups such as government organizations, informal museums, science centers and research centers" and focuses the curriculum on science, communication studies and science & technology studies. Based on the profiles described in Mulder's model the profiles of science communicators are 'PR, science communication advisors, science policy advisors, science journalist, and employees at science center/museum' which matches with the combination of the science communication studies. However, there are still some programs which state in their objectives or career profiles to aim at cultivating some particular science communication professionals but do not include relevant studies in the curriculum. Several programs include profiles of science communicators at science centers but do not organize courses related to the area of 'educational studies' while some programs aim to train students to take into account the social issues regarding science and technology but fail to structure courses in the 'science & technology studies' area.

Conclusions and Recommendations

The paper explores how the science communication curriculum relates to the professionalism of science communicators by investigating twenty science communication university master programs worldwide. To answer the main research question: *Do science communication university programs equip students to become professionals*?, the relations between the programs objectives, structures and contents of the curriculum, and the profiles of communication professionals were explored. Based on the results it is still doubtful to what extent the science communication programs equip students to become professionals. Most of the program objectives are too vague, with no indications of either the prerequisites or the basic requirements within each area of study. Also, most of the programs do not give clear descriptions on the profiles of science communicators, although most of them organize the curriculum to accommodate different areas of study with combinations of interdisciplinary subjects which matches with the professional profiles in the Mulder model. Due to the vagueness of the program objectives, insufficient descriptions of profiles and the lack of coherent link between the curriculum with the objectives and profiles, for potential students the relation between the curriculum and the professionalism of science communication is not visible at all.

From the conclusions above, we suggest that science communication university master programs should pay more attention to providing clearer information regarding the curriculum for potential students. Several recommendations are proposed:

-The profiles of science communicators could be used as a basic guideline for developing the curriculum by centering program objectives, the structure and content of curriculum to reflect on the real world of science communicators.

-Each program should provide clear objectives and profiles of science communicators, with given examples or references to the activities and organizations of communication professionals.

-Each program should stress its own strengths and uniqueness to market their programs, and emphasize on how the objectives and USPs relate to the profiles.

-The programs should be clear on how the courses in the four areas of study fit into the profiles.

-The part of the curriculum which does not belong to the four areas of study, for example

internships and research projects, should also be addressed and linked to the profiles
- Since it is stated that for professionals a recognizable and valued concentration of knowledge and skill (Priest, 2010) is important, more research is needed on the key activities of science communication professionals to establish the competences in order to provide a clearer overview for the profiles of science communicators.

Discussions

Regarding the quality of the research, there are certain limitations regarding collecting information online, whether the information reflects truthfully on the actual status of the program researched, or whether the information is complete and accessible. A qualitative interview or survey on relevant actors of the programs (coordinator of the program, students or alumni) should be the next step of this research to increase the validity of the results. To grasp fully the status of science communication university master programs worldwide, it is also essential to continue collecting more information on the programs, and include successful examples.

In our opinion, regardless of the large differences of the subjects within each area of science communication study or the lack of coherence of the curriculum worldwide, the existing science communication university master programs are still successful in the regard of providing students with a general overview of what science communication is. As a new discipline where communities coexist (Bell, 2010), we think that the development and organization of the curriculum is a dynamic process and will certainly change in accordance with the growth of the discipline, the development of science communication research, and also the profiles of science communicators. Although there remains much differences and varieties in the organization of science communication curriculum in the existing programs, perhaps at the same time it is also one of the advantages in this discipline, in which its flexibility and dynamic nature can accommodate more opportunities and possibilities in developing the curriculum. Thus, the universities should definitely not rush to conclusions and decisions on a program with a fixed structure. Rather, they should work on drawing up visions and views for the status of science communication, how the discipline fit into the academic level of study within the university and also what resources the universities have to offer and contribute to the program.

It will certainly be challenging to remain the flexibility of designing and developing a science communication curriculum with so many uncertainties. Adaptations should be made to meet a broader and higher level of societal needs and also from different circumstances in different countries, where different communities, possibilities and disciplines coexist.

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Arts Based Science Communication Approaches to Create Awareness

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Abstract. Technological advances have revolutionised knowledge generation, but while knowledge is increasing exponentially, access to complex and interconnected datasets becomes a problem not only for specialists. Scientific advances at rising pace leave the general public increasingly doubtful about benefits provided by research, irrespective of the fact that research remains the basis of modern societies. The enormous body of knowledge generated by research appears inaccessible even to specialists and awareness of simple scientific facts is complicated to generate. We have successfully explored arts based approaches in science communication providing emotional access to scientific facts and supporting awareness rather than knowledge generation.

Keywords: Art, awareness, emotional access, knowledge generation

Introduction

Historically people have benefitted greatly from scientific advancement. But while science impacts on every aspect of our life now, there is a growing sense of distrust in the scientific method at least in the developed world. Clearly science and technology are central to knowledge-based societies, but with increasing possibilities the potential of harmful consequences is also rising. As a result, the dissemination of science and technology and broad public engagement have become a focus of publicly funded activities, which can be summarised as science communication (SC).

Science Communication with an agenda

The Universal Declaration of Human Rights states in Article 27: *Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.* Also the Lisbon agenda for Europe brings home how deeply inscribed science remains in our contemporary societies. In the perceived societal consensus that science is a central functioning principle of civilization roots a supportive science journalism. In parallel publicly funded SC activities are performed with the purpose to promote acceptance of technology, career choices etc. Thus actors within SC frequently have an agenda and thus lack independence in the view of a critical public.

But SC has to be more than the education of citizens and the provision of information about science, namely the construction of meaning and design of techno-scientific futures. SC should thus be about building a shared understanding which can promote some sort of change, might it be in perspective or action. The solution is to perform SC in forms suitable for communication and dialogue. But communicating science in ways that are useful and meaningful for both science and society remains an unresolved challenge not least because the deficit model underlying the public understanding of science remains very strong amongst scientists, policy makers and the media.

Challenges in Science Communication

According to the deficit model the public was to marvel at science, learn the basics at school and experience technological change in their workplaces, while science and technology and the choices about its future directions remained in the hands of scientific elites[1]. Many scientists and science managers regard the public as irrational and not able or willing to understand or engage in sound argumentation. Moreover, society becomes a source of regulation and prohibition. From such an attitude, re-contextualisation is seen as something forced on science, rather than as a challenge to do better. Current initiatives at public engagement are already seen as going too far, and autonomy should somehow be restored. In this aspect SC faces several critical challenges [2,3].

While Article 27 reflects on a close link between science and art, in public opinion and the perception of many researchers, science can be separated from society. Linking arts and science thus might bridge this perceived gap.

Communication Models Lack Emotion

Prevailing peer-to-peer scientific communication widely frowns on emotional qualities, favouring objectivity and personal detachment. These professional standards are often imported into communication strategies to non-specialists, despite the fact that scientists frequently relate to their research with high emotional quality. Recent research identifies emotion as one of the key determinants for our memory[4]. As our sensory input is processed, it is associated with emotional valence and arousal, the two dimensions of emotion. The most vivid memories tend to be of emotional events, which are likely to be recalled more often and with more clarity and detail[5,6]. While the effect of emotion in advertisement and communication appears to be common place, in learning it has been widely neglected[7]. Using arts based approaches as an emotional anchor for complex scientific ideas is thus an innovative approach, promising on the basis of recent research.

Art provides emotional access to facts

Knowledge and awareness are clearly distinct, as is apparent from numerous examples where action is avoided despite better knowledge. Only awareness of a fact will result in appropriate action. Art is a powerful means of presenting truths and associating subjective and emotional experiences with facts which supports awareness building. Art also connects people in a society by presenting an idea that everyone can relate to in a universal way. Therefore art has the potential of overcoming some current challenges in SC.

Art in our successful SC activities

Figure 1. Farmer Hans and DiNA the genetically engineered hen discuss the pros and cons of transgenic production of medicine

In our view SC is challenged with the problem to provide instructive access to complicated issues, where direct access to the scientific process is limited. Therefore methods are sought, which can provide emotional access to scientific facts. We have argued that successful communication of complex scientific content with lasting impact requires emotional access to create awareness and arts based approaches might be fruitful in this respect. dialog<>gentechnik has used art in different SC activities successfully:

Theatre: In a 20 min play about DNA technology aimed at children of 8-12 years “farmer of the future” Hans tends meticulously to his prized hen DiNA, which was genetically engineered to produce antibodies as medication against cancer in her eggs (Figure 1). DiNA is a chimera, as her chicken DNA contains a small piece of human DNA as well. DiNA is upset and has many critical questions about this human piece of DNA in her chicken cells, which Hans with the help of the audience tries to answer. After the play visitors are offered the opportunity to isolate DNA from vegetables and/or draw chimerical animals. They are asked to give their

Figure 2. Two 11-year old visitors prompted after the play to draw a chimeric animal supplied the following description to their drawings: (top) Name-Helper, Special Features-lives in the desert, plants seeds and produces medicine; (bottom) N-Croco-Chicken, SF-explosive eggs

drawings a name and specify their specific features. While many drawings are inspired by popular culture (Harry Potter etc) a surprising number reflect on transgenic approaches (Figure

2). However, while there is no visible change in the genetically engineered DiNA, most children, when drawing their animals do combine different body parts, which are usually associated with the special features. We therefore conclude that young children can reflect on the principle of genetic engineering. The principle of transferring traits between species with a specific purpose appears to inspire the imagination at least of some children. Even in the absence of a deeper understanding of gene technology therefore this play can create awareness of the power of modern methods of gene technology.

Figure 3. Paint your PhD was performed on a scaffold 10 m high with 15 scientists painting for one hour their research topic life in front of an audience.

Painting: The public perception of scientists is dominated by stereotypes, which are recognised to be hard to change and also decrease the likelihood of youth to choose science as a subject. The majority of respondents to a survey in the US are aware that they are under informed about science and scientists, moreover the media is considered to do only a fair or poor job at portraying science[8]. Direct access to real life science, like scientific work places, can make the public more aware of the true nature of science and scientists, thus contributing to changing stereotypes[9]. However, as this access is limited we have chosen an arts based approach highlighting the similarities between scientists and artists.

Few people are aware of the fact that science is part of our culture, and the work of scientists is usually only acknowledged within their peer-group. Relating scientists with a cultural profession like painters, in particular in Vienna, which prides itself on its cultural status would associate scientists with more positive stereotypes. We created an activity to provide scientists with a “stage” for their work, make it interesting for the public and raise the awareness that science is an inherent part of our society and culture. During the European Researcher’s Night 2009 in Vienna we performed the activity “Paint your PhD”. A scaffold was erected for 15 paintings to be produced live during the event by 5 PhD students, 5 post-doctoral researchers, 5 team leaders (Figure 3). They were asked to give a title and a brief description of their research topic, which was provided on site to more than 500 spectators. The one hour of painting was accompanied by improvised life music and a Jury judged all paintings in the 3 categories. The winners received an award and three paintings were auctioned on site for a charity, while the remaining where auctioned via ebay raising more than 3.000 €. The initiator of Paint your PhD Chritoph Campregher was himself surprised by the success of his concept: “Sciences and arts are known to be linked. But with Paint your PhD it became very clear, that scientists can also be artists. Even the jury, both renowned artists, were impressed by the artistic potential scientists showed.”

Figure 4. Ivana Primorac–“*Regulation of substrate recognition by the Anaphase Promoting Complex/Cyclosome*”, one of fifteen paintings created during the “Paint your PhD” activity in 2009 awarded 1st prize by the Jury and auctioned for 1000 € on the night for charity.

According to audience reactions and evaluation questionnaires of the entire event this activity conveyed vividly the high personal identification and creative approach to science researchers take. One spectator wrote: “It was a remarkable experience in the extraordinary surroundings of the Rinderhallen to see by what a different choice of means those fifteen researchers condensed the complex topic of their PhD thesis in one painting. They had, however, one thing in common: it was obvious what an intense time those three, four years must have been ...“

The high identification of scientists with their subject of study became apparent through the intensity of their painting. Several scientists had apparently prepared sketches (Figure 5) and one scientist was continuously coached by his wife. The high level of dedication of scientists, which is contributes to negative “mad scientist” stereotypes, in this activity was reinterpreted as a positive characteristic. Even on the video available the intensity of the activity is detectable, the hard work and time investment of the scientists referring to their positive motivation and work ethic. Therefore by showing how scientists paint their research topic, the audience was made aware of the fact how scientists approach their research.

Figure 5. Ivana Primorac holds a sketch for her painting, which apparently she had prepared for the event.

Music: Music is frequently used to lower barriers and make content accessible. Even people of low education listen to complex music with enjoyment during a movie and there is no specific prior knowledge required to experience music emotionally. Music is also highly versatile, it is part of popular culture and can be combined with other art forms, most notably dance. Music also serve as mood cloud providing emotional cues to subconscious listeners. There have been numerous attempts to translate genetic sequences into music[10], since D. Hofstadter first mentions the similarities between genes and music[11].

The composer Sascha Selke was commissioned to develop a tonal system for proteinogenic amino acids based on their chemical properties. A preliminary assignment is shown in Figure 6. This allows compositions about biological phenomena like evolution by translating involved protein sequences into appropriate musical themes. These themes are then used in a composition to reflect biological phenomena and will provide a general music interested audience with access to biology.

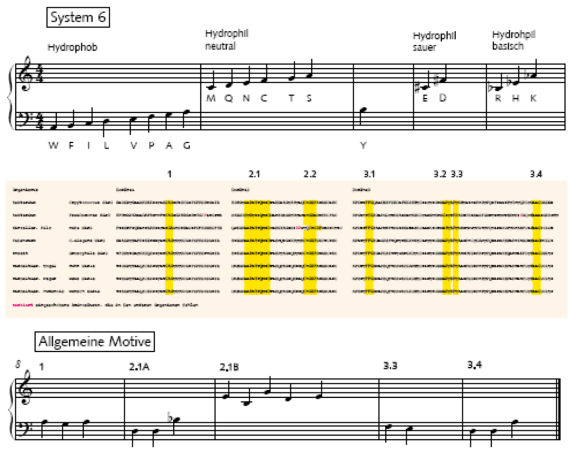

Figure 6. A sketch of the tonal system where each proteinogenic amino acid is based on their chemical properties associated with a note (top). Conserved sequence motifs of a gene (sir-2; middle) can therefore be translated into musical themes (bottom).

In contrast to other gene to music approaches this Selke aims at yielding accessible musical pieces, which are enjoyable to listen to. He uses genetically determined themes and strings them together with conventional musical tools, which allow him to play to the listening habits of a potential audience. This approach is therefore expected to yield music which provides instructive access to complicated scientific topics like evolution or the cell cycle.

The first musical piece has not been performed life so far and therefore no experience with this approach is available.

Visual Arts: Despite the advent of modern technology biology relies heavily on observation and visual data. More than 80 % of data reported and published in biology are images and modern technologies are used to generate these visual data. Scientific images are therefore the most important source of information in biology. Beyond their information content many images have an aesthetic quality and competitions (ie Nikon small world competition) regularly yield stunning images.

Figure 7. J. Lauth and P. Koger produce a dynamic and highly vivid combination of scientific images.

Vienna boasts a lively scene of visual artists, who have grown from modern party culture into an independent art form recently. Their dynamic treatment of digital and visual data combined with a highly technical approach lends itself to a co-operation between scientists and artists. Jan Lauth and Peter Koger were commissioned to produce a visualisation based on scientific images which were produced for a scientific images competition for the European Researcher's Night in Vienna (www.forschenistkunst.at). Based on first-hand experience how microscopes work and scientific data is collected and generated they will project dynamic visuals into the large dome of the Vienna Planetarium with commentary by the well-known Austrian scientist Renée Schroeder in November 24, 2010. A documentation and reactions from the audience will be reported.

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Turning Digital Divide into Digital Opportunity-A Critical Analysis

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Introduction

India is the second most populous nation in the Asian region behind China. The country has achieved impressive progress in the field of science and technology and is emerging as one of the strongest economies in the developing world. Information and communication technologies have brought significant changes in development of the Indian society.

The digital divide is defined as the gap between those individuals and communities that have, and do not have, access to the information technologies that are transforming our lives.

Information technology is transforming various aspects of our life all around the world. No other technology is as profound as information technology (IT) in human history has had a great influence on the economy and lives of people around the globe. In India the benefits of IT are beginning to be seen and the impact of these benefits are creating great change. But a large section of population, mostly in developing and under-developed world, is not getting the benefits. This segment is characterized as people on the other side of the digital divide. It is not literacy, but IT-literacy that divides society into digital haves and have-nots. The unequal access to information and communication technologies has led to a massive divide digitally.

The paper discusses initiatives made in India towards digital access to information and the role of several programs in bridging the digital divide.

Today in India, except a few elite Indian Institutes of Technology and some other public and private engineering and management universities, most higher-education facilities do not have functioning computers, except for maybe a few in their libraries. While college officials have computers in their offices, many don't know how to use them; they have their assistants check and print out emails for them. Although most students are computer savvy thanks to numerous internet kiosks in big cities, and even in small towns, many colleges don't use computers and technology as teaching or research aids.

Although India has been one of the emerging super powers in IT, the benefits have been remarkably slow, particularly in rural and remote areas. Besides socio–economic factors, geographic, educational and attitudinal factors have been some of the challenges for the government when introducing IT–oriented programs.

The World Wide Web or the Internet has conked out all boundaries and has tried to integrate itself into one large depository of information, and a system for universal message exchange. Accessibility to Internet, with an email address has become the minimum basic certificate for an IT-literate. Having an email address helps one to get universally connected to all IT-literates, but it is the accessibility to Internet (and the benefits that come along with it) that converts the IT-literate group into the community of digital haves.

The paper highlights the hurdles and barriers to digitization and the need for strong determination, good policy–making and political support in bridging the digital divide in the country.

Scope of the Paper

The scope of this paper is to critically evaluate the efforts made in India in bridging the so called digital-divide. The scope of this paper is to highlight the reflections rather than to sharply draw any conclusions.

The fast developments that have taken place due to technological changes have also propelled a great divide of the information haves and have–nots in the country. The unequal access to information has posed challenges to the government to take appropriate steps to bridge the gap.

Some of the efforts made by the government and the non–governmental organizations to bridge the digital divide in the country.

The discussion is based on information collected from various reports, documentary sources, facts and figures and e–resources available to asses the efforts made towards bridging the gap between the "haves" and "have–nots" in remote and rural areas. The discussion is based considering the parameters:

(a) The growth and development of the information society.

(b) The Initiatives, opportunities and prospects made towards bridging the digital divide.

(c) Barriers to bridging the digital divide.

Growth and Development of the Information Society

Information and communication technology has given rise to many benefits in our society. Tools like television, radio and the much talked about Internet have always given direction to change. The application of IT in various fields and Internet technology has been able to influence larger sections of society since its development.

Technological change is the major contributor to the growth and development of the information society; e–learning, e–libraries, e–health, e–governance, etc. have become pillars of the information society. Raising these concerns, a world summit was organised by the United Nations in 2003 in Geneva, under its General Secretary, Kofi Annan. The goal of the summit was to develop a common vision and understanding of the information society and to draw up a strategic plan of action for concerted development towards realizing this vision. Access to information in society is not uniform and globally there has always been a gap between those people and communities who can make effective use of IT and those who cannot, leading to a kind of digital divide.

The government of India has declared IT as one of the thrust areas for the country's development and has recognized it as an "essential service. In India the use of IT and computers began way back in 1978. In 1985 the government decided to increase the pace of information technology at the district level.

The National Information Centre (NIC), a central government organization, that was chosen to implement a national programme called "DISNIC," Information System of NIC, to computerise all district offices. Commissioning nearly 500 computer centres to a country–wide network, and connecting these computers, was a major breakthrough in this field that led to remarkable social changes. Earlier, people were reluctant to this change thinking that it would take away people's jobs. But today a remarkable change in mindset is apparent. Many state governments like Andhra Pradesh in Hyderabad, Maharashtra in Pune, Delhi and Noida have Cyber Parks, Karnataka in Bangalore, etc. have developed cyber–cities.

Challenges and Barriers to Bridging the Digital Divide

Although the country has increased its literacy rate to an encouraging 65.38 percent according to the 2001 census, much more efforts are required. The government has made steps to improve the lives of common people through several projects. But we need to look closely at Indian society.

The nature of Indian Society

India is a developing nation which is geographically vast and varied. India is a multicultural, multi–language and multi–religion country with complex socio–economic conditions. The growing population, insufficient funds, and delays in implementation of government policies and programs have been some of the challenges that have lead to unequal development in the society.

Due to these characteristics it has its own compelling challenges. For a country with such large population and scarce resources, computer technology comes as a great tool of social transformation. It has already revolutionalised the field of communication and in convergence with mobile and internet technology is changing the way Indians communicate.

Facilities like supercomputers are quite at disposal of few urban elite intellectuals like scientists, engineers and policy makers and makes indirect impact on the population in general. While some people are rich and have many resources, others do not.

Few years ago, a low-cost handheld dubbed the Simputer was touted as a way to give villagers in poorer countries access to computing power. That dream remains elusive. Very few Indian villagers have even seen one, and the government agencies and nonprofits that were target buyers have barely bitten.

The educational system of India also has been slow to achieve the set target framed by various commissions and committees and schemes launched from time to time.

Indian society in general has slowly awakened to this computer revolution and technological advances are also being made taking into consideration the requirement of different segments of the Indian society.

A fundamental requirement for reducing the digital divide in countries is to give priority to the development of their communication infrastructure and provide universal and affordable access to information to individuals in all geographical areas of the country. There are a number of barriers to bridging the digital divide. Although underserved communities in India are gaining access to computers and the Internet their benefits are limited because of the following factors.

Infrastructural barriers

Despite the incredible growth of the Internet since the early 1990’s, India still lacks a robust telecommunication infrastructure with sufficient reliable bandwidth for Internet connection. Due to high costs the necessary upgrading of hardware and software is cumbersome; hence, despite the rapid spread of the Internet the gap is growing wider as the technological standard grows even higher. Faster networks, higher level machines, more complex software and more capable professionals are required, but in many nations including India the funding is not available to support these developments.

Libraries and information centres , with their commitment to freedom of access to information and promotion of life–long learning in India, are yet to have a robust infrastructure.

Literacy and skill barriers

Education and information literacy will play an important role in keeping society from fragmenting into information haves and have–nots. In the perspective of the digital divide, IT literacy is very important to allow access to digital information. In a country like India where roughly 50 percent of people do not have reading and writing skills for functioning in everyday life, IT literacy is out of the question. Generally, online content and information have been designed for an audience that reads at an average or advanced literacy level and those who have discretionary money to spend.

Education in information literacy will play an important role in keeping the society from fragmenting into a population of information haves and have–nots. The lack of skill in using computer and communication technology also prevents people from accessing digital information.

Economic barriers

Poor access to computer and communication technology also causes a digital divide. In India the ability to purchase or rent the tool for access to digital information is very less among the masses.

Public libraries which can provide access to the Internet do not have computers and Internet access. Although cyber–cafes have been increasing at evry nick and corner, poor people cannot afford to have access due to high costs.

The lower income group does not have money at their discretion to spend on cyber–cafes or to get Internet connectivity on their own to access digital information.

Content barriers

The Internet allows ideas and information to be shared freely from citizen to citizen globally. In many ways the strength of the Internet is a function of the number of people and organizations creating quality content. Since no entity controls the Internet, anyone with Internet access has the potential to contribute information. Therefore, to solve the digital divide, steps should be taken by the government to ensure that all citizens are able to receive diverse content relevant to their lives as well as to produce their own content for their communities and for the Internet at large.

Language barriers

India is a country having a multicultural and multilingual population. India is divided into states on the basis of language. Even though the Indian government works officially in English and Hindi, the language of administration differs from state to state. The Eighth Schedule to the Indian Constitution contains a list of 22 scheduled languages.

Due to British rule, English is understood in all the states and is therefore works as a common thread of communication between all the states. Hence when computer was introduced in India, English became the language of communication with computer as well. But general public's inability to understand English became the biggest block in reaching out to masses.

When we look at the statistics of Internet pages, 84% are in Latin based scripts (i.e., English, French and other European languages), 13% in CJK scripts (Chinese, Japanese, and Korean based scripts), and all other languages of the world combine to make up for the remaining 3%.

There is no precise statistics available for Internet pages in Indian languages, and it is estimated to be at most around 0.3%! India is a multilingual country having 18 recognized languages written in 12 different scripts including Arabic and Latin (English).

The remaining ten scripts are Devnagari, Bangala, Gurumukhi, Gujarati, Oriya, Tamil, Telugu, Kannada, Manipuri and Malayalam. These have evolved from the ancient Brahmi script and they are together referred as Indic scripts. If we include the People of Indian Origin (PIOs) staying in other countries, it is estimated that around 22% of the world population speak languages that are written in Indic scripts. Then why there is only 0.3% Internet pages in Indian languages?

Unicode

The Indian Government had realised in 1980s itself the need to make computer accessible in all Indian languages. It focused on two key issues: script encoding (the way an Indian script should be stored in computer memory or disks) and keyboard standard for all Indian scripts. For script encoding, it proposed ISCII standard (for 8 bit encoding), and in 1998, UNICODE standard (for 16 bit encoding). Unicode is becoming far more attractive as this scheme treats all scripts of the world uniformly, and the most of the Internet browsers (since the year 2000 like Internet Explorer, Mozilla, etc.) are giving an in-built facility to view any Unicode encoded Internet page written in any script, or any mixture of scripts. Furthermore, the most famous and powerful search engines like Google has started accepting search words and phrases in Indian scripts, and its search coverage encompasses all those sites whose pages are encoded in Unicode.

Yet, there does not seem any accelerated growth in Internet pages written in Indian languages?

To develop a site in Indian languages you need mechanisms to input Indic scripts. The Department of IT (formerly the Department of Electronics), the Government of India, standardized INSCRIPT keyboard layout for all the ten Indic language scripts as early as 1991. INSCRIPT keyboard standard is a bilingual keyboard, i.e., English with one of the Indic scripts. In contrast, most of the countries in the world are monolingual, and hence a keyboard with a single script is sufficient for their use.

At present, to input any Indic script, we have two mechanisms: (a) use a bilingual keyboard, or (b) display the "Indic keyboard layout on monitor," and choose different letters through the mouse. The latter scheme is usually not used in those applications where user interactivity is very high (e.g., word processing). The bilingual keyboard comes in two styles: (a) Key tops are engraved with Latin script and one Indian script, or (b) the key tops of standard Latin keyboard are pasted with a paper/plastic film which has Latin and one Indic script printed over it. Usually, it is the latter case of usage, as the market of bilingual keyboard has not picked up yet. This latter scheme has a strong limitation, as after sometime either the paper/plastic films on the key tops get torn, or get dirty. This makes the keyboard illegible and unusable. Further, the people who are not familiar with English do not feel at home with either of these two solutions. And this is the main cause of digital divide!

Further, this bilingual keyboard does not permit to mix two or more Indic scripts, e.g., Hindi & Bangala, or Hindi, Tamil and Kannada, etc.

We feel that there should be only one keyboard (call it Brahmi) that can be used for any of the twelve Indian scripts (including Latin and Arabic) simultaneously. The Brahmi keyboard will have key tops with LCD display, and the letters are displayed, not engraved. In addition, there should be a "script selection knob" to switch the keyboard from one script to another at any time, irrespective of its state. With Brahmi keyboard, a user can type any mix of the 12 Indian scripts in his text, and this single keyboard can be used throughout India!

To develop Brahmi keyboard none of the research institutes or CSIR labs would be interested, as there is no research content in it. Neither a venture fund will be interested in putting money as the estimated cost of Brahmi keyboard would be far higher than Rs. 300, the present cost of an English keyboard. The result is the perpetuation of digital divide! But is there any way to get out of this trap?

CDAC developed a GIST technology which has to its credit several innovative products and cutting edge technology which have revolutionized computing and made GIST synonymous with Indian Language Computing. Its areas of Research are impressive and cover the full gamut of computing: Natural Language Processing tools (such as spell and grammar checkers, natural query), Search plug-in's, Semantic Web, Video Technologies, fonts technology, expert writing systems, image processing (Optical Character and Handwritten character Recognition), Speech Processing, Embedded and Mobile Computing to name only a few.

Today GIST technologies forms an integral part of mission critical activities of various organizations. Mindful of the social function of computing the GIST technologies also powers the National initiatives especially meant for masses in the areas of e-Governance, education, agriculture, health, banking and communication and so on.

Google's transliteration effort

The latest to contribute to the development of software offering uniform platform to Indian languages is the software giant Google. Transliteration is the method to enable users to enter text in one of the supported languages using a roman keyboard. Users can type a word the way it sounds using Latin characters and transliteration script will convert the word to its native script. Till recently this service was offered online only–means you need an internet connection for transliteration. Now Google has launched the new transliteration software–"Google Transliteration IME" which enables offline transliteration also.

This is available today for 14 different Indian languages–Arabic, Bengali, Farsi (Persian), Greek, Gujarati, Hindi, Kannada, Malayalam, Marathi, Nepali, Punjabi, Tamil, Telugu and Urdu.

Conclusion

The unequal access to information and communication technologies has led to the digital divide not only in developing countries but globally as well. It goes against the well known adage-that the world is a global village as proposed by Marshall Mc Luhan. Although India has made encouraging efforts to bridge the gap by initiating a number of projects and programs for rural and remote areas, much more needs to be done to bring the people into the information society and make them active participants in the process of development. All that is required is strong determination among people, good policy–makers and political support to bridge the digital divide.

Libraries and information centres play an important role in providing information to all in order to reduce the gap between those who have the facilities to access digital information and those who do not.

Although peer-reviewed journals have been available on the Internet for many years, the digital divide has continued to pose as a challenge for the developing world. The digital divide is keeping out the developing world from very useful research information. This Bridging would give researchers free access to high quality research articles. This drastically improves the quality of research input in developing nations.The country needs to improve the infrastructure of public libraries and link them with community information centres. International support can help developing countries to benefit from technological advancements and enhance their productive capacity.

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The Interactive Platform of Science Communication in Science Center

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Abstract. Science Center (Science and Technology Museum) is a new science communication institution, it plays a special role of carrier in improve the public's scientific literacy. Mass media, such as television, newspapers, computers and Internet, is still an important way for the information dissemination and exchange. How to employ the mass media to build up the interactive platform of the public and Science Center in science communication is a challenge. This paper analyze the characteristics of mass media and science communication, research how to build the interactive platform to promote the science communication and take the science activities in Guangdong Science Center for example.

School and Children as a Media to Educate the Public about Science

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Abstract. Communication is indispensable to science. Knowledge that is not communicated is worthless. It is also crucial however, that the communicated knowledge is correct. The communication of knowledge plays an increasingly vital role in a global knowledge society facing challenges in areas such as the climate, nutrition, ageing societies, maintaining biodiversity and others. Scientific literacy is increasingly important to function in society. School media (especially children) are the primary source of communicators on science and technologies. Developing effective science and technology based educational programs is more complex than it appears at first blush. This paper tries to explain how school and public science can form a fruitful interaction. The purposes of the study reported here was to document and evaluate the role and effectiveness of our Science eco-club and assess our organizational framework. Science and eco-clubs are a unique opportunity to educate children about science environmental issues. objectives include: (1) educate children about their immediate environment by increasing awareness; (2) impart knowledge about eco-systems ,science and technology their interdependence and need for survival, through visits and demonstrations; (3) mobilize children by instilling a spirit of scientific inquiry into environmental and scientific problems; and (4) involve children in active science and technology, environmental preservation efforts. We have introduced Uniform and Band along with a structured programme of formation of disciplined five teams of student cadet for water, plants, energy, waste management, land use planning, and these disciplined teams are involved in school level or community level physical environmental actions.s exclusively in our School Science eco-club. Our Cadets are the Green Brigade of the school, protecting the natural resources from misuse and promoting the conservation of the natural resources. Final Findings show that the science eco-club provides: Self confidence, new life skills, Model for peer groups, Social responsibility. Remember, our travel should not become travail for others. Let us give it a thought; let us become more considerate towards fellow beings; let us change our attitude and bring in a change. Nature as an arena for the quality of life is a topic of utmost concern, for it will impact on future generations.

Keywords: Mock eco assembly, NGC camps, NGC environmental discipline, Science eco-clubs

Introduction

Science eco-clubs are internationally recognized as a powerful tool to change the community through the activities of children. India's National Green Corps (NGC) Science eco-clubs are a unique opportunity to educate children about environmental issues. Objectives include: (1) educate children about their immediate environment by increasing awareness; (2) impart knowledge about eco-systems, their interdependence and need for survival, through visits and demonstrations; (3) mobilize children by instilling a spirit of scientific inquiry into environmental problems; and (4) involve children in active environmental preservation efforts. The aim of the Science eco-club is to develop a green consciousness social responsibility: and through Our Science eco-club we are trying to groom the Cadets as an environmentally disciplined force. We have introduced Uniform and Band along with a structured programme of formation of five disciplined teams of cadets water, plants, energy, waste management, land use planning, exclusively in our School Science eco-club and these disciplined teams are involved in school level or community level physical environmental actions. Science eco-club activities constitute: (1). Spreading the Word and (2) Launching an Action, as follows. (A) Eco Walks (B) Eco Rallies (C) Eco Demonstration (D) Eco Placards Display and Eco Banners (E) Environmental Road Shows (F) Environmental Speeches (G) Environmental Seminars (H) Environmental Activities and Campaigns (I) Students Environmental Projects (J) Mock Eco Assembly/Parliament and (K) Environment Exhibitions. As part of the science eco-club Activities School environmental Audit Program performed at our school in November and December 2009.Nature as an arena for the quality of life [1] is a topic of utmost concern, for it will impact on future generations. Our Cadets are the Green Brigade of the school, protecting the natural resources from misuse and promoting the conservation of the natural resources. Our science eco-club is expected that there will be huge difference made to the way the resources are consumed and conserved.

Program Design

We live in a globalize world. Acknowledge of this, means accepting that we must adapt and prepare ourselves as best we can; so we need to redefine and make changes to meet the new demands of the 21st Century. In education, this has generated a radical turn within classroom and school pedagogical processes. The core knowledge and competencies that support self learning and life-long learning have now a fundamental role in the student's learning process. Many new educational proposals suggest the need of rethinking education, so that students grow up to be good citizens, capable of living together in a democratic, inclusive and pluricultural society within a complex and changing social environment. A competency based education teaches students to develop the knowledge, skills and attitudes that allow them to solve daily problems; to keep learning through out life; to be an ethically responsible person; and to respect and be able to work with others, as demanded by globalize world. It is a means of aiding in the personal development of students that will eventually prepare them for the challenges society and work sets before them.

While some states in the country are still grappling with the implementation of the NGC program, Andhra Pradesh has become the first state in the country to upscale the National Green Corps to cover all the schools in the state through the establishment of the Directorate of National Green Corps. This is a tremendous step towards developing a cadre of environmentally aware citizens.

It has also been the first and only state in the country to implement the Supreme Court's decision on environment education in formal curricula by preparing special textbooks for standards 1 to 10. This is unprecedented in the country.

The NGC program has been appropriately designed to ensure effective implementation. The NGC team has developed a close collaboration with key individuals in the Education Department even on a personal level ensuring adequate support for the program.

NGC Environmental Discipline

Today Environmental Movement in our country lacks focus on "Environmental Discipline". The need of the hour is to create Environmental Discipline in the younger generation. Earlier NGC Students Environment Movement was based on Environmental action. This was a step ahead from environmental awareness. Now since there is a need to move forward in order to protect our environment and ourselves, NGC took a stand to instill Environmental Discipline in 8th class students through 5 NGC Eco club teams in each NGC School. The first step is to promote disciplined movement and action promoting environmental discipline. This is a clear shift of NGC from environmental knowledge promotion to environmental discipline promotion.

National Green Corps programme aims at spreading 'environmental discipline' among school children and involves them in environment related actions in the schools and communities. Children have infectious enthusiasm. They are custodians of natural resources and nature.

We all know that we are part of the environment we live in, and the solution to many environmental problems lie in our attitude towards environment-be it awareness to keep our surroundings clean or the realization to conserve natural resources by re-using and recycling wherever possible. On the surface it looks simple. But changing the attitudes of people is not going to happen overnight.

The best way is to initiate community into action through children. They have no vested interests. They are impressionable. They are our future. They are the single most important influence in any family.

Activities:

1. Building 5 NGC natural resource management teams in each school and conducting NGC weekly parade drill for 20 weeks along with band.
2. Conducting Daily Natural Resource Monitoring through 5 NGC students' teams and Annual School Environmental Audit by November every year.

3. Participating in District level parade on 15th August Independence Day and 26th January Republic Day.
4. NGC Eco Club Student Cadets will be in charge of retaining cleanliness in the mid day meals or daily lunch time and also greening the school premises.

In the above context NGC trains PET/PD of the selected/registered schools. The NGC training program covers parade drill and natural resource conservation monitoring and environment audit.

Objectives

- To create environmental discipline among school children.
- To train young students for environment action.
- To utilize the unique position of school children for awareness of the society at large.
- To facilitate children's participation in decision making in areas related to environment & development.
- To bring children into direct contact with the local environmental challenges and respond positively.
- To involve children in disciplined action based programmes related to environment in their neighborhood.

NGC Parade Foot Drill

The aim of the drill is to inculcate discipline, improve smartness in appearance, turnout, and self confidence and to develop qualities of team spirit and obedience in the cadets

NGC Camps

Let's learn and enjoy. AP NGC is promoting 'environmental discipline' amongst students through NGC Eco Clubs. Promoting environmental discipline and action are on the agenda for conducting camps at various towns in Andhra Pradesh

Each NGC Camp will cover the following aspects:
1. Drill practice
2. Band practice
3. Natural resource use monitoring and auditing.
4. Visit to locations environment improvement activities

National Science Day on 28th February

It is envisaged that thirst for knowledge and desire to innovate can exist among students at varying degrees of preparedness, from urban to rural regions. To enhance the awareness, interest and opportunities at all levels for innovative thinking, multi-level competitions on regular basis can be of great help. To enhance the need of developing such an attitudes our Science eco-club organized school level celebrations of national science day on 28th February, 2010 in that we conducted essay writing competitions as follows: "Disaster Management Importance of Science" elocution competitions: "Planet Earth-Natural Resources-Sustainability".

Earth day April 22:

Earth day is an annual observance held on April 22 every year to increase public awareness on the environment. Earth day activities offer important point of entry to address world wide environmental concerns as well as opportunities for individual and community to focus on their local environmental problems. Earth day should be used as a powerful catalyst to involve people in making a difference towards a healthy, prosperous and sustainable future. Keeping in mind the importance of Earth Day, the Science Eco-Club celebrated the Earth day–2010 with the active involvement of School Community, on the auspicious occasion of the Earth Day: Cycle Rally cum public awareness programme was conducted.

Week Programme in Our School

We have conduct week long environmental programme in the schools by forming into teams for water, waste management, energy, biodiversity and land use planning by taking an oath to protect environment. On the first day we prepare a school map incorporating the resource we are responsible for including the drinking and waste water routes, waste pockets and location of trees. On the second day our focus is on water tank cleaning and monitoring and tree plantation and plant protection. On the third day, we focus is on planning & making arrangements for rain water diversion & harvesting and Playground, Parking planning, school cleaning, dust bin introduction. On the fourth day, we conducted Quiz, Essay writing and Elocution competitions along with Eco Cultural programmes. On the fifth day we the focused on planning composting of waste and linkage with the local waste handlers and conducting the Mock Eco Assembly and the final day activity is to plan Science eco-club management, Eco calendar and reporting the progress through the School Wall Magazine.

Mock Eco Assembly

Grooming in Leadership and Environment Awareness: Our Eco-club organized A ‘Mock ECO Assembly’ At our School the Participants Came in Batches, Posing as Legislative Assembly Members from the Ruling and Opposition Parties, Sat at the right and left sides respectively and exchanged views and concerns about environment issues facing the Country. We feel that, we are the future youth leaders presenting our views on the steps to be taken for the welfare of the country and how to work towards achieving India, a dream nation and stand high in the World. As The Mock Eco Assembly Was Aimed At Instilling Confidence, Improving Communication Skills And Environment Awareness In Children at the same time the eco assembly programme are to strengthen the roots of democracy, to inculcate in the young minds healthy habits of discipline, tolerance of views of others and to equip them with the knowledge of assembly procedures and eco friendly practices.

Eco School Audit Process and Green Schools Programme Report

The Eco school audit process assists students in conducting audits and develops action plans on air, energy, land, waste management and water management in the school environment.We are done all the chapters simultaneously, as five teams are working on the five different resources. Five teams comprising of children from class VIII & IX coordinated by the teachers, one each for the five, segments are responsible. There are 5 to12 children of mixed classes in each group. All the teacher coordinators have found that children are enjoying auditing their particular resource.

Major Findings and Suggestions of Eco School Audit

Water: Sanitation facilities and Rain water harvesting methods have to be improved with the help local public representatives.
Air: Oxygen balance has to be improved by planting and protecting of trees.
***Land*:** Green area has to be improved by planting the trees in the forth coming rainy season and Special policy document has to be followed on land use and biodiversity.
***Energy*:** Renewable energy resources have to be adopted in Mid Day meals Cooking and Using CFL bulbs have to be encouraged.
***Waste*:** Collection of used text boos at the end of Annual Exams by the school and to maintain Book Bank and Some manure pits and land fills have to be dogged in the school.

Environmental Camp:

The National Green Core (NGC) and Tirumala Tirupathi Devasthanams jointly organised `eco camp’ has really empowered and ignited the young minds during their 10-day stay at the most popular pilgrim centre of the country. A total of 49 students representing different schools got an opportunity to spend their time learning and enjoying at the TTD from May 22 to 31 as part of their `NGC-TTD Eco camp’. We were exposed to different activities right from serving the pilgrims at the huge kitchens where free Annadanam is offered to the pilgrims coming from different parts of the country. We visited sewage and solid waste management plants, water filtration beds, nursery management, solar cooking, wind mills learning the alternate sources of energy and energy conservation methods in practice. We only studied in text books about the wind mills, but they got to see practically during their visit to the temple at Tirumala. “It is quite unimaginable,” and with this visit. “We learned a lot about water filtration process and solid waste management. We made lot of discoveries that really surprised us,” The students – members of the Eco Clubs functioning at various schools across the district were picked up by the NGC only to expose them to the environmental protection methods and putting to use the non-conventional energy sources. From this we were also made to inculcate a sense of service by drafting them to duties serving the pilgrims at various points. The main objective of the camp was to make every student a responsible citizen and activate the Eco clubs formed at various schools.

Conclusions

Science eco-clubs make a difference. Science eco-club schools are showcases that influence other schools and local communities and by sharing their experiences they transfer environmentally friendly technology to the communities through a community based environmental movement. There are solutions to the major problems of our time; some of them even simple. But they require a radical shift in our perceptions, our thinking, and our values." (Fritjof Capra, 1996).

Final Findings shows that the science eco-club provides: Self confidence, new life skills, Model for peer groups, Social responsibility.

"Earth has enough for everyone's need but not enough for even one's greed"

Mahatma *Gandhi*

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Mentoring Network Model and Evaluation Scheme

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Abstract. Little is known about the evaluation scheme of measuring how successful a mentoring is. There are no tools of success factors for formal mentoring program. In this presentation we introduce the Mentoring Network Model (MNM) based on a formal mentoring program at the WISE (Women into Science & Engineering) Main Center at Ewha Womans University.

The Mentoring Network Model (MNM) is a visualizing model to represent the human networks among mentors and protégés by using a network diagram. The model contains not only people participated in the mentoring but also all members' relations such as friendship, alumnae, colleagues in the same organization, and neighbor.

By assigning three factors- node, relation and field to the MNM, we analyze the MNM. The nodes represent members and relations between two nodes are expressed by a line and the field is the physical or virtual area representing nodes and the relation in a 2-demension rectangle. If some mentors are belonged to same department of an organization, they can be assigned in same field.

We introduce three indexes- affinity, time and grid-complexity related to the relation of MNM. *Affinity* (A) is an index for affinity between two members. The affinity is based on the age gap, locality, and personality. We assume the closer network, the better condition for mentoring. The second index, *time* (T) represents the quantity or time of mentoring activities. We assume the more frequent on-line and off-line interactions between two persons make the index T bigger. The last index, *grid-complexity* (G), is a complexity index that shows how many relations per node exist in a model. By defining three factors and indices to MNM, we introduce an evaluation scheme how successful the mentoring is. We apply this MNM to WISE mentoring fellow program.

Keywords: Mentoring model, Mentoring network model

Values and Evaluation: Leximancer as a Tool for Analysing Values in Science Communication Transcripts

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Abstract. Best practice science communication research, practice, and evaluation often dictates the use of focus groups and interviews, and yet techniques for analysing data from such collection methods are rarely discussed. This paper reports on the use of Leximancer, an automated text-mining software tool, to examine and compare transcripts from two focus groups. Participants included in this study were part of an upstream engagement process aimed at getting leading Australian farmers together to form a cooperative group to disseminate scientific information about managing climate variability and climate change. Findings from the study show that while cursory automated qualitative analysis of transcripts may not serve as a substitute for in-depth analysis, they may be complementary.

Keywords: Science communication, Values, Focus groups, Engagement, Transcript analysis, Leximancer

Introduction

Qualitative research methods such as focus groups and interviews are commonly employed mechanisms for assessing attitudes and perceptions of participants in science communication engagement activities. They are also frequently recommended as evaluation tools for such activities (1-2). However, while many of these guides describe how to carry out focus groups and interviews, there is little direction offered on what to do with the data once they are collected.

In this study, I conduct an exploratory qualitative investigation of two different focus group conversations using an automated textual analysis tool known as Leximancer. Leximancer is a highly customisable text mining software tool that uses word frequency and co-occurrence to identify families of terms (3). In essence, Leximancer uses lexical relationships and a thesaurus to develop "concepts" and then "themes" from documents (4). It has been used in both academia and industry to examine a variety of texts including interview transcripts, websites, surveys and emails, in fields such as History, Literature, Media Studies, Sociology, Politics, Psychology, Management, Business, Tourism and general Communication; however, its use and profile in science communication has been limited to date.

The observations made in this paper are not intended as a best practice guide, but offer some insight into how Leximancer may (or may not) be useful for analysing focus group transcripts.

This study is part of a larger project examining participant, organiser and facilitator values in emergent engagement. The study's specific aim is to determine the usefulness of Leximancer as a tool for identifying values that emerge from value-oriented talk in upstream science communication. However, this specific aim does not distract from the goal of this paper in assessing its usefulness for science communication focus groups more generally, since I am simply considering Leximancer's "themes", which are made up of "concepts", as potential values. While at the early stages of this project, where emergent values are not defined as yet, I also make some preliminary observations about the use of Leximancer to elicit "values" in transcribed conversations.

Method

Data were obtained by recording focus group discussions, which were then transcribed and subsequently analysed using Leximancer. During the course of the analysis, and after, I reflected on the subjective usefulness of Leximancer for analysing science communication focus group conversations, and particularly for eliciting values in such conversations.

Participants

In March 2010, twenty-four of Australia's leading farmers from across the meat, cropping, dairy, sugar, bee keeping, wine and wool industries met in Canberra for a two-day induction into a group to be known as "Climate Champions". The Climate Champions program was established in recognition of the role of peer interaction in how farmers gain new knowledge and adopt new practices. It aims to put farmers who are knowledgeable about managing and adapting to climate variability and climate change in touch with other farmers. From a science communication research perspective, the

Climate Champions program presents a rare opportunity to observe emergent upstream engagement, as the group was asked to define their own objectives and criteria for success before the trajectory of the program was decided.

The program is supported financially by five Rural Research and Development Corporations: Grains Research and Development Corporation, Meat and Livestock Australia, Dairy Australia, Rural Industries and Development Corporation, and Sugar Research and Development Corporation. It also receives communication support from an environmental and science communication consultancy called Econnect Communication, as part of their contracts with the Managing Climate Variability Program—a research funding body funded by the Australian Commonwealth Government, and the Grains Research and Development Corporation's Climate Change Communication Campaign.

As part of the induction to the program, participants were separated into small groups (four to six people) for facilitated discussions. This paper examines two of those conversations in detail.

Focus groups

Facilitators were nominated by the organisers of the event and provided with a facilitator's guide outlining questions for each session. The conversations examined in this paper come from a forty-five minute session designed to elicit participants' responses to three value oriented questions:

- How will you know if the Climate Champions program has been successful?
- What will be different because of the Climate Champion program?
- What will be the value of Climate Champions?

Facilitators for the two groups used in this study consisted of 'K' from one of the sponsor organisations and myself, 'M'.

Leximancer analysis

One of Leximancer's most appealing features is that it enables the user to automatically identify significant themes (i.e., words with the greatest number of relationships to other words) and concepts (i.e., words that occur frequently) in text without any prior knowledge of its contents. With this in mind, I wanted to know what themes (i.e., potential values) would emerge from analysis of the conversations—both taken together as part of the upstream engagement as a whole, and considered separately. What were the potential values for both groups together? And what were the potential values for each of the groups?

In addition, I wanted to learn about Leximancer's ability to account for the influence of context in conversation. Did it matter if turns in speech were represented sequentially? Would there be a difference in results if facilitator and participant speech were extracted from one transcript to produce two and then combined in Leximancer, compared to leaving the transcript intact (i.e., speech combined contextually)?

To explore these questions, transcripts from two of the Climate Champions focus groups were loaded into Leximancer v3.5, and compared in the ways described above. The standard options were selected, as well as "merge word variants" (e.g., communicate and communicating) and "apply dialog tags" (i.e., M: and K: to denote who is speaking) selected. Transcripts were parsed to produce separate transcripts for each of the facilitator's speech and each group's speech (i.e., six transcripts in total: M's transcript intact, K's transcript intact, M's speech alone, K's speech alone, M's group's speech alone and M's group's speech alone).

Concept maps for each of the analysed conditions were generated (shown in Section 3 below) under default viewing conditions (i.e., none of the sliders controlling detail have been adjusted). Labelled circles denote "themes"—larger circles are considered main themes and colours are assigned randomly. These "themes" are generated by related "concepts" identified in the text, which are denoted by dots within the circles. Lines connecting the dots denote pathways in the text between concepts. For the purposes of this study, I will focus on the comparison of themes, as I am investigating the possible use of themes as potential "values".

Some may consider the level of analysis performed in this study to be rudimentary. Indeed, Leximancer is equipped with more features and options than what will be discussed here. However, by adhering to Leximancer's more basic features, I am both minimising researcher influence on the outcomes of the data, and simulating a realistic level of knowledge that other science communicators might be likely to acquire after undertaking a similar degree of introductory training as I had, or less.

Findings

Analysis of two groups combined

Leximancer concept maps may be useful for gaining a sense of the content of text, without actually knowing what it contains. Figure 1 below shows the concept map generated for both group transcripts in this study, analysed together. Results show four main themes encompassing many concepts (i.e., relatively larger circles): "change", "people", "research" and "successful"; and seven other themes (i.e., relatively smaller circles): "farm", "time", "terms", "management", "year", "saying" and "cause".

Figure 1. Concept map for all group data (both transcripts) in context

In this study, I was interested in the themes that emerged as potential values in the conversations. In observing the interactions during meeting, facilitating one group and transcribing the recordings, I was familiar with some of the content and was able to make some decisions about acceptance criteria for themes as "values" in the conversation. For example, the themes "cause", "saying" and "terms" from Figure 1 seemed like inappropriate values for the conversations, and so I decided to investigate this assumption further.

I noticed that two of these suspicious themes—"saying" and "cause"—are located in the periphery of the cluster and not touching or overlapping any of the other themes in Figure 1. These themes could therefore be taken to relate less to the other themes/concepts.

I also looked at the thematic summary (shown in Figure 2), which gives connectivity and relevance ratings for each theme. I noticed that "saying" and "cause" also ranked low in the list in terms of connectivity and relevance.

Theme	Connectivity	Relevance
change	100%	
people	56%	
research	46%	
successful	46%	
farm	22%	
time	13%	
terms	13%	
management	07%	
year	07%	
saying	02%	
cause	02%	

Figure 2. Thematic summary for all group data (both transcripts) in context

Further investigation of these terms in the transcript showed that "cause" was used mainly as an abbreviation for "because" (e.g., "'cause they're going to…") and "saying" was used to describe what was happening in the conversation (e.g., "I was saying…" and "So you are saying…"). This further confirmed my assumption that their suitability as "values" was questionable.

While the theme "terms" ranked more highly in the comparison in Figure 2, the transcript revealed that it was used as part of the expression "in terms of" and was therefore also unlikely to be considered an appropriate "value".

Leximancer facilitates the exclusion of particular terms in its analysis in at least two ways: words can be added to the default stop list of words that are removed from the analysis prior to generating concepts, or concepts can be removed prior to the generation of themes. However, manipulation of the data in this way introduces user subjectivity, detracting from any claims that might be made about neutrality in making use of Leximancer. Furthermore, the removal of concepts may not elicit more refined results. For example, removing old concepts may result in new concepts of questionable use to the user, as illustrated in Figure 3 where the concepts "cause", "saying", and "terms" (i.e., inappropriate values) were removed from the emergent concept list.

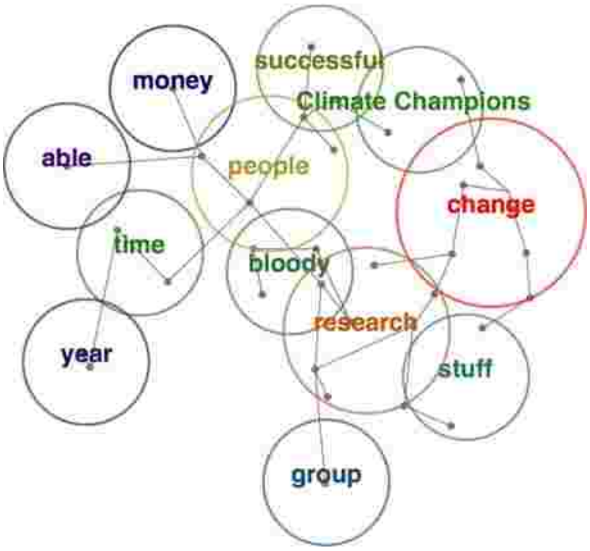

Figure 3. Concept map for all group data (both transcripts) in context, "cause", "saying" and "terms" removed as concepts

While the four original main concepts remained (i.e., "change", "research", "people" and "successful"), the relative size of "successful" decreased. New themes that might be considered useful potential values were added: "Climate Champions" and "money"; however, new themes that are unlikely to be useful as values also emerged: "bloody" and "stuff".

Comparison of two groups analysed separately

Leximancer concept maps may be useful for comparing the content of two texts, without actually knowing what they contain. For example, Figures 4 and 5 below show the concept maps generated for each of the group transcripts in this study, analysed separately.

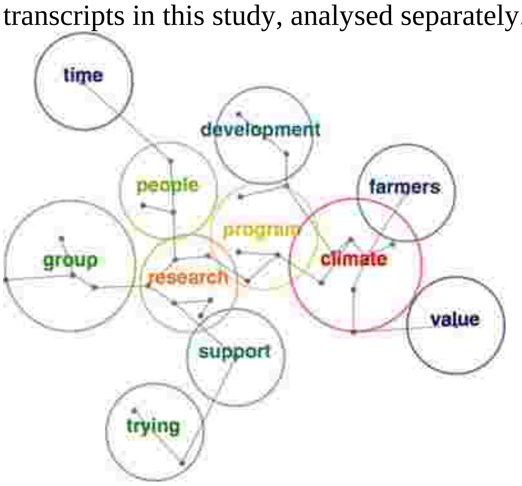

Figure 4. K group in context

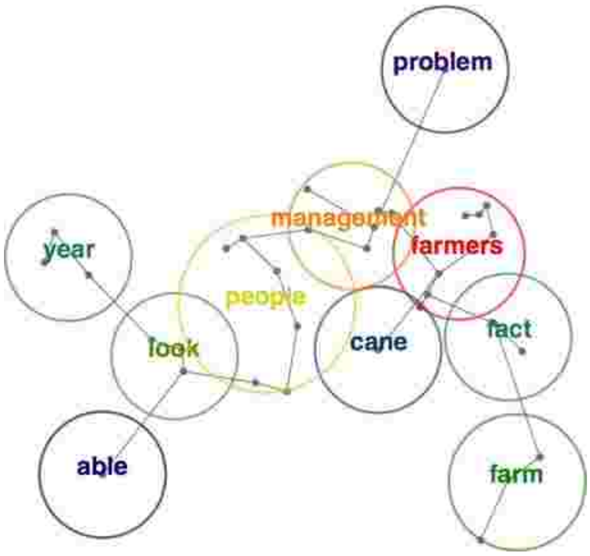

Figure 5. M group in context

At a glance, a comparison between the two groups showed few circles with the same labels, suggesting few similarities. However, a perfunctory explanation of each of the texts could be produced using some of its themes. For example, "something about developing a research program having to do with farmers and the climate" for K group and "something about cane farmers using facts for farm management" for M group. While these clusters of themes provide a sense of the topic of the conversations, without prior knowledge about what occurred in the transcripts, it would be difficult to know how representative such stories might be.

Concept maps could be used for more direct comparisons of the data. For example, Table 1 below was produced to show a simple comparison between the themes of both groups.

Table 1. Comparing themes between groups

Comparison	Themes
Common themes	"people", "farmers"
Similar themes	"time" (K)/ "year" (M), "trying" (K)/ "able" (M)
Uncommon themes	(K) - "climate", "research", "program", "group", "support", "development", "time" (M) - "management", "look", "farm", "fact", "cane", "able", "problem"

In constructing the table, I could reason why some themes were common, similar and different. However, without knowing the context that each of these terms was used, it would be difficult to know whether "people" was a common theme for both groups for the same reasons or whether uncommon themes were really uncommon or describing similar things (e.g., "research" and "look").

What was particularly interesting were the differences between themes in M group and K group taken separately (as in Figures 4 and 5), and then combined (Figure 1). Some of the main concepts stayed the same (e.g., "people" and "research"), while others were lost and/or were replaced by new themes (e.g., "climate" and "program" were lost, while "change" and "successful" were gained). Instead of having all the themes from each of the conversations as a contributing theme in the combined analysis, some kind of mediation had occurred and a more refined concept map resulted. In other words, individual speech contributions did not maintain their prominence when combined with other contributions.

The influence of context

In addition to mediation of contributions by members of different groups, Leximancer may be sensitive to context (e.g., ordering of turns in speech) in conversation. To investigate this sensitivity, I separated speech contributions from the facilitators of each group from the group contributions, and then analysed the four transcripts together to produce the concept map in Figure 6 below. Note that the text itself is the same text as was used to generate Figure 1, but in this case, the contributions were considered out of context (i.e., not in general "facilitator question - participant answer" format).

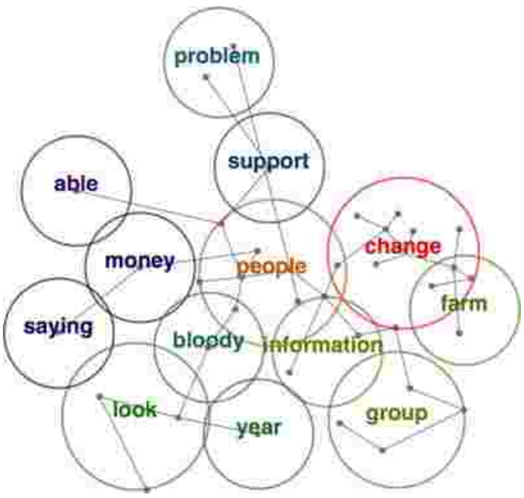

Figure 6. Concept map for all group data (both transcripts) out of context

A comparison between Figures 1 and 6 showed a slight refinement (i.e., fewer number) of themes when the transcripts were taken in context. Once again, the results of the combined data gave a sense of mediation within the conversation. For example, adjectives like "bloody" and directives like "look" may have been important in the conversation rhetorically, but did not contribute to the themes when taken in context.

Discussion

The combined results of these comparisons in the analysis lead to a few observations about the use of Leximancer to analyse focus group conversations.

First, the extent to which Leximancer may be considered useful as a tool depends on what it is being used for. Leximancer aims to help the analyst avoid fixation on potentially atypical or anecdotal evidence by making them aware of the broader context and significance of concepts (5). Analysers invariably approach their data with expectations and prior assumptions about their meaning. Leximancer provides them with the opportunity to quickly test their assumptions. For example, many of the themes I would have initially expected to be important in the transcripts in this study (e.g., policy making and funding) were missing from the Leximancer analysis, while other themes (e.g., money and year) were unexpected. Leximancer offers a way to test assumptions about data like these, and be challenged by the results. In this way, analysts can widen their own value-lenses and be reflexive in their analysis.

Second, Leximancer's usefulness for analysing focus group conversations is limited by the user's understanding of its operation. The way that I have described its use here—to perform a cursory investigation through its default settings—leads to a very superficial understanding of the data. While it is possible to gather the essence of a conversation using basic features in Leximancer, doing so does not provide a particularly meaningful analysis on its own. It is difficult to make sense of the themes in Leximancer without an understanding of who is saying what, and in what context. For example, in this study, it is not sufficient to have the theme "research" (which is both a noun and a verb) without knowing that the term was generally used to describe the farmers' desire to participate in research and give feedback to researchers.

Likewise, themes cannot be compared between groups without an understanding of how those themes emerged (e.g., “terms” as part of the expression “in terms of”).

While Leximancer can be configured to perform a more in-depth investigation than what has been described here, there are tradeoffs for users who engage Leximancer’s more advanced features for analysing focus group conversations. Not unlike traditional, non-automated qualitative analyses, users should be aware that their own values influence what they consider to be important in the conversation they are examining. Leximancer offers a variety of ways to explore this influence—from choosing words to be included and excluded, to considering certain combinations of words and numbers of lines. For example, in further iterations of the analysis described in this study, I would exclude words such as “stuff” and “bloody” because they are not themes that I am interested in. However, in doing so, I would be detracting from one of Leximancer’s main strengths: the ability to limit the influence of researcher bias to produce themes from data.

Thirdly, from the comparisons in this paper, I believe that Leximancer does have some sensitivity to the influence of context, albeit not in the way that users might like it to have. There was a difference in results when facilitator and group speech were separated and then analysed, but to what degree this analysis is able to account for the flow of conversation (e.g., facilitator question – participant answer) is not clear from this study.

Finally, in examining Leximancer’s ability to extract values, I think its strengths lie in its use as a tool for reflexivity. In this analysis, consideration of themes as potential values was useful only insofar as I was able to use my own judgement about what might suitably be considered a value.

In summary, while Leximancer appears to be a useful data-mining tool, it may not serve as a substitute for traditional thematic analysis of conversations when used in the way I have described. However, Leximancer analyses may add value to traditional transcript analysis techniques, even if it might not replace them.

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Communicating Science via Art Installations

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Abstract. Science is part of our everyday lives, and so is art. Particularly, art installations require an active presence; thereby they contribute to the raise of awareness, promote understanding, and generate an emotional response. This project seeks to explore the connection between art installations and science communication through experiential learning. The sample for this study consisted on two groups of participants. One was exposed to a list of scientific facts, the second one contributed in the creation of an art installation. The results as a whole, suggest that art installations does aide in long term fact retention. Therefore, the creation of art installations can be considered an interesting media to convey science in an attractive, reliable, and memorable way.

Keywords: AEIOU, Art installation, Experiential learning, RIRC method

Introduction

Science is one of the disciplines that is constantly struggling to achieve a better diffusion of its knowledge. We are conscious of the difficulty encountered in achieving the above goal. It is because of this that sometimes, the public becomes discouraged in its attempt to penetrate the scientific world and erroneously avoids the topics that are of great significance to the evolution and development of the world. In light of this, how can we foster an interest in scientific knowledge? How can we construct a bridge between science and society in general? How can scientific knowledge be part of our culture and daily experience?

It is important to mention that in recent years, education has become a multidirectional, inter-disciplinary process, in which different subjects try to give an explanation of the world that surrounds us. Science is no exception; discovering common elements with other disciplines will facilitate the communication of scientific knowledge and values in a way that is easy assimilated.

With the goal of bridging the gap between science and public, the following investigation rests on two fundamental axes: experiential learning and artistic “installation.”

Experiential learning

Experiential learning alludes to one of the most important methods of knowledge acquisition, in which sensory experience, imagination, and long-term memory construction play a pivotal role. If we recall Aristotle, the first experience revolves around the senses. Later on, a process of repetition and abstraction of ideas is carried out, in which once having interacted with the images that are created by the imagination, sensory experience becomes intelligible to create knowledge. One of the advantages of experiential learning is that it achieves not only short-term, but long-term knowledge acquisition.

The cognitive process involves making connections, exploring patterns and capturing the big picture with all of its details. One of the elements that help the memory retain information is the mnemonic system. This refers to the process of the mental association of ideas; it involves schemes, systematic exercises, and repetitions in order to facilitate the process of memorization. (O'Brian 2000) The mnemotic system also uses visual aid to establish associations easy to be remembered. We often discover that mental images last longer than facts. The capacity of the human mind to remember images is generally larger than that of remembering words. The imagination is the way of mentally representing a sensation, and the memory is the way of retaining it. As Einstein once said, “Visual images are the antechamber of words.”

The psychologist Carl Rogers distinguishes learning in two different types: the cognitive (insignificant) and the experiential (significant). The first corresponds to academic knowledge such as the learning of Spelling lists or multiplication tables. The second refers to applied knowledge: such as learning about motors in order to repair an automobile. The key to the distinction is that experiential learning takes into account the needs and desires of the public.

According to Rogers, learning is simplified when the student completely participates in the process, has control of, and can direct, his or her learning. It is important that the participant confronts the information with social or personal experiences. Finally, self-evaluation will be the principal method to obtain successful results. Rogers emphasizes the importance of always being open to change in order to update and generate new knowledge. (Rogers 1969)

Art installations

Art, specifically postmodern contemporary art, is starting to take force as a learning tool in education institutions. The ways in which it is applied are different; nevertheless, there exists a pronounced line that consists in involving feelings, emotions, creativity, and knowledge in only one process in order to reinforce cognitive learning. (B. 2006) Art motivates the student to learn and helps him or her to develop higher-order thinking skills. (O'Farrell 1994) Art is valuable since it encourages different forms of human intelligence; it can fulfill the purpose of both entertainment and education. (Gardner 1983) The creation of art results in the conjunction of information with the imagination; this way the audience uniquely conceptualizes the represented reality.

Artistic installation is a contemporary art genre that began to take a strong hold in the artistic community beginning in 1970. The installations incorporate many artistic mediums to create a visceral or conceptual experience in a determined environment. In general, artists of installations incorporate the demonstration space, using it like another element of the work; whether they are public spaces, museums, art galleries, or even urban spaces.

An art installation is an expression that is realized in a multidisciplinary and multisensory approach. It consists of a work in which its creation is part of the technique and also of the ultimate expression, involving the active presence and participation of the spectator. (Morales Morales 2009) This active presence is what interests us as a participatory element in the diffusion of scientific topics. For a long time, science lived behind laboratory walls, but today, it is not only necessary for people to understand it, but to take possession of it, to live it and to experience it, and to express an opinion regarding its role in everyday life.

The importance of using artistic installations as a medium of scientific diffusion is founded in two elements. First, it turns the public into an active participant in the creation and conceptualization of the work of art; therefore the public acquires experiential learning. The flexibility characterized by artistic installations permits themes or topics to be expressed in different forms, textures, sounds, sizes, smells and colors, emphasizing the importance of a first sensory approach. In this way multisensory learning is adapted and internalized by the participant.

The second factor is that we recapture one of the forms previously used in the comprehension of scientific topics: AEIOU learning (this term was developed by T. W. Burns, D. J. O'Connor and S. M. Stocklmayer in “Science Communication: a Contemporary Definition”).

AEIOU learning

Scientific communication (SciCom) is defined as the use of skills, means, activities, and dialogues adapted to produce one or more of the following personal responses towards science: Awareness, Enjoyment, Interest, Opinion-forming and Understanding. (T.W.Burns 2003) The diffusion of science through artistic installation seeks to incorporate the five components through a process of active participation and scientific information that have been conceptualized in an artistically-designed expression. This type of communication seeks, through an existential metaphor, to design a bridge between imagination and critical thought, as well as between the public and science. The result is a rational opinion, which, thanks to the metaphor, alludes to conscience forming regarding the topic.

The practical section of this investigation includes the previous design, and the creation of an artistic installation that conceptualizes, in this case, the topic of environmental deterioration and the consequences of the cycle of consumption. To carry out the project and to measure the level of acquisition of scientific knowledge, two groups were formed: a control group called the factual group and another group called the art installation group. The first group was exposed to information related to the topic of the deterioration of the planet Earth. The installation group had access to this information while at the same time, created an installation where each material and form represented one of the facts.

RIRC method

It is important to use a method that helps us analyze the effectiveness of science communication via art installations. This way results can be measured, and according to the analyzed data we can think of better ways to improve the stimulus. In this case, we used the RIRC method (A. y. Negrete 2010) to evaluate the comprehension and retention of scientific knowledge. RIRC method uses three tasks to measure explicit memory (involves a conscious recollection of data): declarative knowledge, recognition, and recall. The method also includes a task that measures implicit memory (involves the use of previous experiences that are not consciously recollected): procedural knowledge.

Declarative knowledge refers to facts being recalled, recognition implies identifying elements that were previously learned, and recall is about producing a fact, words or a story that has been retained in our memory. Finally, the tasks that involve procedural knowledge are those in which abilities or behaviors are learned and can be remembered. These groups of memory tasks were designed in order to measure how the public learns and retains information, as well as the different levels of understanding the provided information. (A. y. Negrete 2010)

The RIRC method was originally used to compare and contrast the performance of public exposed to scientific facts using narrative forms. Due to the characteristics of an art installation, the use of different forms, odors and materials, help create different ways of understanding and perceiving the information. The part regarding Opinion-forming (represents the “O” in the AEIOU method) differs from participant to participant it is important to analyze the way in which consciousness is address by each one of them. The art installation had an extra task involving procedural knowledge in order to understand the relation established between facts and the art installation concepts.

Objectives

1. Explore the possibility of art installations as a media to communicate scientific knowledge.
2. Compare and contrast how participants understand and remember information from a list of facts and through experiential learning.
3. Develop opinion forming through a meaningful sensorial experience in order to obtain a personal consciousness about, in this case, environment deterioration.

Stimuli Development

The objective of this section is to fully explain the process in which the stimulus was presented to each group. From now on, we will refer to the first group as the “factual group” and the second group as the “art installation group”. The factual group was exposed to a list of scientific facts. The art installation group participated in the creation of an art installation while scientific facts were provided to them. Each group was composed of 17 participants between the ages of 20 to 23, all of them current students.

During the first session, the factual group was exposed to a list of ten scientific facts concerning environmental deterioration. (Table 1) After ten minutes, a questionnaire (the characteristics of the questionnaire will be explained further on) was handed to them and had fifteen minutes to complete it. The second group assembled an art installation following a specific procedure. The group was divided in 3 teams: green, black, and yellow. Each one of them had a specific task during the construction process. A procedure sheet (Table 2) and a diagram (Fig. 1) were given to each team describing the assembly process, as well as the responsibilities for each one of them. After the installation was completed they were asked to answer the same questionnaire as did the factual group.

Methodology

The questionnaire applied incorporated 4 different tasks to fulfill the requirements of the RIRC Method.

Table 1. Scientific facts
This is part of the evolution process of human being on Earth. Are we doing things the right way?
The Earth was formed 4.5 millions of years ago.
The “homo” appeared 2.5 millions of years ago in the Paleolithic period.
A great part of humans existence is known thanks to art expressions. This is how the human being has left its mark.
Since the first half of the XX century, the human being has been considered the greatest super-predator in habiting the planet Earth.
We have finished with the 80% of forests on this planet.
Each person produces 2 kg of garbage every day.
If every country would consume the way the United States of America does, we would need 5 planets to get enough resources.
In the past 30 years, we have terminated with 33% of the natural resources on the planet.
Our economy demands us to consume. Buying has become a ritual to achieve spiritual satisfaction.
The process of buying things is resumed in 5 main steps: Extraction–production–distribution–consumption–disposal.

Table 2. Resumed procedure
1. (EVERYONE) Arrival to the meeting point. Leave your shoes in the black corner. In the patio, you will find a specific shape made out of masking tape. Recognize it and form a circle around it of approximately 10 m. of diameter. Each team will remain together, pick a leader. Identify, using the diagram sheet provided, the location of the pile of leaves, the recycled garbage, and the shoe pile.
2. (GREEN TEAM) Each integrant will pick as much leaves as possible from the leaves pile. They will be placed as shown in the diagram. When you are done, the leader will raise his hand and the team will return to the circle.
3. (BLACK TEAM) Each integrant will pick several pairs of shoes from the shoe pile. They will be placed as shown in the diagram. When you are done, the leader will raise his hand and the team will return to the circle.
4. (YELLOW TEAM) Each integrant will pick several cans and bottles from the recycled garbage pile. They will be placed as shown in the diagram. When you are done, the leader will raise his hand and the team will return to the circle.
5. (EVERYONE) Make sure the figure is exactly the same as shown in the diagram, make any adjustments if necessary.

One question involved the free-recall task (Retell): Mention all the facts that you can recall from the given information. A five item list of the most important concepts was established that enclosed the given scientific facts. The maximum points for this task were 5.

For the recognition task (Identify), 3 multiple choice questions were designed. Therefore,

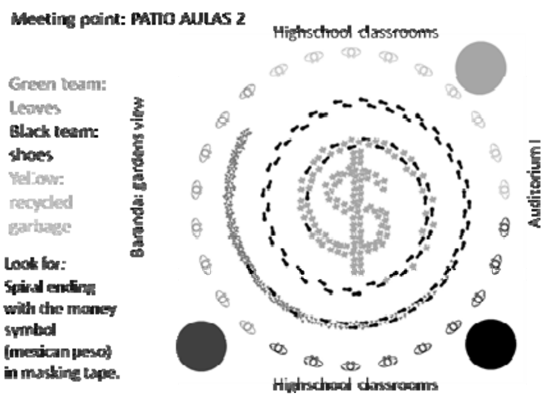

Figure 1. Diagram

the maximum possible points for this task were 3. In order to have an optimal answer the participant should have been able to identify the mentioned fact from a series of possible options.

For the recall (Remember), two types of questions were considered: short answer and fill in the blank. This kind of tasks helps to measure the information that can be produced using explicit memory. The maximum possible points for this part were 4.

Question number 9 refers to the procedural knowledge task (Contextualize). The objective of this question was to create a different context, and measure the ability of the participants to apply learned facts in a specific situation. This task is connected to opinion-forming and gaining consciousness.

An extra question concerning also procedural knowledge was applied to the art installation group. Its purpose was to identify the ability of participants to refer scientific facts to material, forms, and colors in the installation. Most art installations intend to provoke an emotion, feeling or sensation among the public. The art installation should have helped them reinforce the retention of scientific facts throughout the senses of sight, smell, touch and hearing.

Results

The results suggest that the factual group had a better performance during the first session compared to the art installation group. The factual group had better results in the four applied tasks, and in general terms the standard deviation of the art installation group was lower that the factual one. (Table 3)

In the second session we could observe differences in the way scientific information was retained. During this session the art installation group had better results in all four tasks. Furthermore, the results between art installation and factual group performance during session 2 are much more apart, than the results obtained in the first session. Although the general standard deviation in the art installation group during the second session is lower, we can observe that in most of the tasks the factual group maintained better homogeneity in 3 out of 4 different tasks. (Table 4)

Table 3. Performance during session 1

	Retell	Identify	Remember	Context	Total
FACTUAL GROUP					
Optimal answer %	58%	78%	75%	59%	67%
Standard deviation	1.65	0.79	1.12	0.75	2.89
ART INSTALLATION GROUP					
Optimal answer %	46%	76%	65%	53%	58%
Standard deviation	1.69	0.69	0.94	0.62	2.54

In the case of the factual group we observe that over time the retained information is lost, especially in the tasks that measure explicit memory. In this area the factual group experienced diminishes of 37% on the number of optimal answers. In the procedural knowledge task the results maintained, but we could also perceive that the standard deviation increased. In the art installation group the results of the second session suggest an improved performance. For the explicit memory tasks, the optimal answers were superior in 17% exceeding the results of the ones of the first session.

The greatest achievement for the art installation group was observed in the procedural knowledge task with a 23% improvement.

The general results imply an upgrading in the performance of the art installation group, while the number of optimal answers diminished in the factual group. The standard deviation data had a similar behavior. In the factual group, results from session 1 to session 2 mostly maintained the same; a slightly higher dispersion is observed. The results for the art installation group show that the standard deviation diminished during session 2. The dispersion of the data suggest that while information presented with a list of scientific facts loses accuracy and uniformity over time, the information presented via art installation gains accuracy as well as homogeneity. The results obtained imply that art installations help enhance scientific knowledge.

Table 4. Performance during session 2

	Retell	Identify	Remember	Context	Total
FACTUAL GROUP					
Optimal answer %	31%	55%	47%	59%	45%
Standard deviation	1.84	0.86	0.86	1.03	2.90
ART INSTALLATION GROUP					
Optimal answer %	65%	86%	68%	76%	72%
Standard deviation	1.89	0.94	1.05	0.85	2.48

In addition, question 10 was used to measure how much of the given information was successfully related to the art installation work. Participants in the art installation group with higher overall results on the 4 required tasks demonstrated a better connection of scientific data to art installation concepts.

Conclusion

The results of this study as a whole, suggest that art installations does aid in long term fact retention; knowledge. (Fig. 2) Therefore, the creation of art installations can be considered an interesting media to convey science in an attractive, reliable, and memorable way. Using the RIRC method gave us the opportunity to analyze quantitatively and qualitatively. This allows having more accurate measurements of the outcome, and encourages compare and contrast analysis.

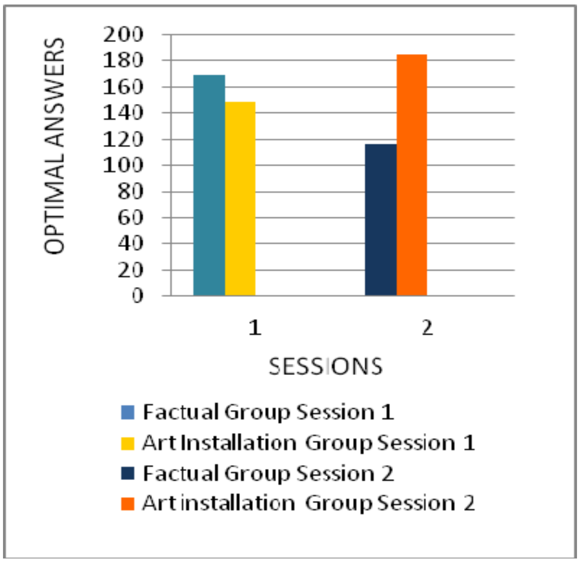

Figure 2. Session 1 & 2 Overall Results

One of the most important aspects that should be emphasized in this investigation is the ability of art installations to sensitize the participants experiencing different objects, feeling them, smelling and hearing scientific information at the same time. Different experiences are perceived, for instance, it is not the same to smell green fresh leaves, than to smell recycled cans and plastic bottles. The objective of experiential learning was reached when the participants' senses were stimulated and a greater impact was produced. Results suggest that this way, information is more accurately retained through time.

Carrying out this investigation resulted in a very insightful experience. The art installation group participants were able to connect facts with the items, forms and colors presented in the art installation. When the communicating process is not only addressed but developed by the public, a different kind of awareness is created. Each participant was able to acquire knowledge in its own specific way; therefore they had a unique opinion-forming during the activity. The ability of a person to develop consciousness is what gives facts an extra value; it is not just about retaining information, but of being able to use it in different situations.

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Virtual and Substantial Vectors in Science and Technology Museum:— Comparison and Analysis of Chinese and Foreign Popular Science Exhibitions

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Abstract. With the development of world science and technology, global exhibition educational programme has entered into a new era. Currently, among 186 countries in the world, Europe, America, Japan and other developed countries have utilized the “4D virtual imaging” as one of the important methods to popularize the science technologies and social conventions. The trend will be completed in a relatively high speed as a consequence of time lapsing and explosive updates in technologies. It can be forecasted in the future. Virtual technology will not only coexist with the entity exhibition but also become a primary educational method.

This paper compares Chinese and Foreign science exhibitions from the aspects such as: the exhibition theories, designs, contents, and the building of circumstances. Try to find the flaws then correct them. At the same time, we have browsed the world famous virtual science and technology museum network, such as New York Science and Technology Museum, Washington Science and Technology Museum, US Astronaut Science and Technology Museum, Lincoln Memorial and so on. We have used statistics to do our research. Meanwhile, we combined these with the reality of our country, analyzed the differences in science technology vectors; audience groups and communication effects. In the future, how to take advantage of new technology to complete science enterprise should be emphasized.

Nowadays, science and technology museums should attract visitors by using novel exhibition methods, The museums can make them perceive the technology and experience the technology from a total different aspect of view. For the purpose of revealing the uniqueness of science, the meanings can not be limited but should be renewed continuously to touch the audiences’ senses. The author believes that the combination between virtual and substantial technology is the only path develop in the future.

Engaging Users in Science and Technology Exhibition CoDesign Online and Offline: the Expolab Experience.

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Abstract. We present Expolab, an experiment on user involvement in science and technology exhibition creation, a joint project of the science communication company La Mandarina de Newton, Citilab (Barcelona) and The Tech Museum in San Jose, California. The project explores novel practical methods for science and technology centres and museums, to become active hubs of citizen involvement and engaging people in science and technology. The approach mixes research, communication and design. It also combines methods that work on a face-to-face basis and the utilization of collaborative Web 2.0 technologies and virtual collaborative 3D environments to develop exhibits with users.

Keywords: Museums, Participation, Co-design, Engagement

Introduction

Science and Technology Museums, like many other museums, are posed with important difficulties to engage their audience in the knowledge they treasure and, in that way, be able to become active hubs for knowledge sharing and learning (1).

The arrival of social media was hailed by many museums as an opportunity to relate in a different way to their audiences (2) and as lever of engagement, replicating similar old claims when the arrival of the web impacted the cultural sector (3). In fact, there is a connection between Web 2.0 technologies and active engagement (4). Museum audiences familiar with 2.0 technologies are, for example, more active in the sense that they read and write more online and offline than the average population and regular museum visitors (5). So, these audiences expect from the institutions to be given a more active role than just being recipients of information and are willing to become more involved. This is a great challenge for current museum strategies (6,7).

Web 2.0 technologies have helped museums realize the possibilities of new participatory projects to engage people in museums' goals, contents and activities. Many of these projects turn the museum into a social aggregator of media and content, either provided by users or remixed by themselves from whatever contents the museum opened for free use. Hopefully, these projects result in an increased social interaction between visitors. This may lead to mutual dialogue and reflection on the museum contents. Some authors (8) make this last claim explicitly. However, participation has many levels and it doesn't necessarily need to be done only through technological means alone.

In fact, initiatives that are too directly inspired by the use of Web 2.0 technologies and their underlying philosophy as their only form of participation tend to exploit just one possible way of engagement: that of letting people contribute with contents, ideas and discussion which, nevertheless, is a very valuable result in itself. They also may be biased towards visitors with some technological background.

Looking for an alternative to exploit the collective aspect of participation, museums can also explore a tradition of collective learning by construction and collaboration that speaks to active users too (9). For example, The Tech Museum pioneered this approach in participation by letting users design exhibits in response to a design brief –a call to create a specific sort of exhibit- by the museum. A precise invitation to create a single type of exhibit was done. Tech Virtual (10), as this initiative is called, has been running for several years now and it is a successful way to engage people in learning about Science and Technology.

Participation as shared learning through construction requires users to become designers. Participation in design and learning is a laddered experience (11). So, one interesting question is what it would be like to go one step further up the ladder and let users co-design a whole exhibition, without an initial exhibit brief, i.e., giving them the chance to decide topics of the exhibition and then co-design it.

The importance of design in Science Communication as a means to improve the presentation and the visualization of Science and Technology communication projects has already been stressed within the Science Communication research community (12). We want to remark here another concept of design where it is not only seen as an ancillary discipline used to improve visual or aesthetic aspects and as a result increase communication effectiveness. Instead, it is taken as a means to draw the users into the actual creation of the object to be designed and, in this way, reach the core of the message the museum is trying to convey. In order to confront such a challenge, it is interesting to resort to user-centric design methods. Design began to involve users long ago. First, as individuals to be observed (13) then, gradually letting them become co-designers (14,15). Slowly, this approach has arrived also to museums (16,17).

We wanted to test user-centric co-design methods, combined with 2.0 virtual platforms (18), and check its use in the definition of a whole exhibition centred on Science and Technology concepts. This is how the exhibition “From contemplation to participation and beyond”, came into being within the Expolab project.

The Expolab process

The Expolab project was created and coordinated by the Science and Technology communication company La Mandarina de Newton in Barcelona. It received the support of The Tech Museum in San Jose, California, and the civic community innovation center Citilab in Cornellà, Barcelona.

The goals of the project were multiple. In a typical design research approach, it started by devising a design research process centred on a clear artefact. The artefact was to be used as a sandbox to test and learn design and communication methods as well as their relationship to 2.0 technologies.

The artefact to be built was an exhibition. The exhibition, although it is a format or genre under much discussion within the museum community (19), still is the flagship of museums. That is why it became our object of choice to test design-based approaches in Science and Technology in museums. The subject of the exhibition was initially defined very ambiguously so that the participants, actual co-designers of the exhibition, could refine and elaborate by themselves the focus, the content, and the actual exhibits.

The institutions giving support to the project were related to innovation in digital technologies. The Tech Museum is in the heart of Silicon Valley. Citilab’s main activity is training citizens in Internet skills. So, the focus of the exhibition was initially vaguely defined as “Internet and what it has brought about”.

We also wanted to explore and investigate if users could design in a more complex sense than just giving shape to the physical appearance of objects. Exhibition design incorporates much more than that (20). In this case, it was felt that in order to connect with the Science Communication tradition in museums, it was important to use the exhibition as a metaexhibition. That is, to explore, show and reflect on the different approaches to Science and Technology exhibition design over time.

The current predominant mainstream approach to Science and Technology museums is the “interactive museum”. It can be traced back to the influential work of Frank Oppenheimer in creating the Exploratorium (21). This was a significant departure from old “contemplative” museums based on the display of object collections, including scientific apparatuses as objects. Instead, Oppenheimer introduced the important concept of experimentation on the scientific phenomenon as the basis for exhibit design. The interactive exhibits in this type of museums initiated a path towards participation, since they require some action on the part of the visitor, which can be taken as a first level of participation. Nevertheless, these exhibits are not always geared towards actual contribution of content or explicitly shared knowledge by the user with other users in the way that, for example, Web 2.0 technologies allow.

The project team proposed as a general constraint for the citizen co-designers that the actual exhibits should integrate (a) a contemplative, passive display of objects related to the subject of the exhibit (b) some form of interaction to explain the science and technology concepts, phenomena and processes around which the exhibit was built and (c) an invitation to other users to contribute content and knowledge to be shared.

In terms of participatory design methods this bundling of different approaches into a single exhibit also posed a challenge, since it involved co-designers in creating something more than a passive object. In fact, the whole exhibition could be seen as a complex system which included personal and social relationships in its design. It also had some reflexivity: citizen co-designers themselves could become eventual visitors. So, they had to think in very complex terms and engage in some level of organizational design. This is at the cutting edge of co-design methods (22). An added level of complexity is that was an international project with institutions of different competences, in different cultural backgrounds. With all these considerations in mind, the project team sketched the design process to be initiated and also the important research dimensions to be explored:

1. Can non-experts design a quality exhibition of a science and technology subject? There is evidence in favour of this hypothesis in art (23).
2. Which subjects would people suggest?
3. What are the pros and cons of engaging participants from all over the world?
4. What is the response of the public towards the process? What are their main motivations to participate?
5. How should we change design methods to involve plain citizens in complex system co-design?
6. What are the difficulties and advantages to combine offline and online virtual collaboration design workshops?

This last question was especially important since the collaboration had a necessary online component, given the geographical distribution of the design and user teams. Also, it was one asset of the project, due to the experience of the Tech Museum in exhibit design through its Tech Virtual system. It, however, evolved as an online collaboration platform, without offline design sessions.

The test design process that we devised initially was a variation of a well-proven methodology for design that uses a generative step, where new ideas are created, followed by a design analytic step and finished by a synthesis into precise, implementable proposals. The envisaged result was expected to be a workable design description for a whole exhibition, clear and detailed enough to proceed to the construction phase. It was meant to be offered under an open Creative Commons licence. Any museum in the world, or any other group for that matter, could use it to actually build the corresponding exhibits. In the following we describe in linear fashion the phases of the project.

Invitation to participate

In order to start the co-design and construction process of "From contemplation to participation and beyond", we looked for communities of interest. In our case, we made an open call using social networks such as Facebook, Twitter, blog networks and also newsletters, personal mailing, and the Citilab and the Tech Virtual websites to let people know we were starting a new project and to call for their participation.

Face to face workshops

We organised three workshops answering to a significant question: "How has the Internet changed your life?" The formulation of this question was very important. It was related to the still ambiguous topic of the exhibition but, although it was precise, it still was very open-ended and made a direct appeal to personal day-to-day experience, which is a well-proven strategy in Science Communication to gather attention and initiate engagement in the public (24).

The workshops were generative co-ideation sessions. During a typical three-hour session participants worked hands-on with issues related to the impact of Internet in their lives. The design language tools were a set of cardboard, clay, wool and cotton threads, wooden pieces and LEGO™ bricks. The significant question that we launched helped in focusing the attention of the users and gave them some hint of what the possible areas of the exhibition could be. During the workshops we used different techniques to lead them into divergent, generative thinking and convergent construction. We describe them in the following.

***Collage making*:** This technique consists in creating collages in order to obtain latent knowledge from participants. It was mainly used to warm them up. Depending on the session, groups between 20 and 40 people shared their memories, anecdotes and experiences about a certain topic. Participants were divided into groups of 4 or 5 people. We provided them with a set of images and we asked them to choose between 2 or 3 photos that they could relate to the initial question of how Internet had changed their lives. They were asked to explain their selection of photos to the rest of their team. Each group created a collage with all the selected photos. Finally, all the groups shared their collages with each other. In this way, co-designers revealed very rich information about their daily life.

***Low-tech prototyping*:** Each group was asked to create a 3D representation of the ideas and anecdotes that had emerged from creating their collages. The objects that they created were the basis for further discussion and many new ideas were generated.

Figure 1. Participant explaining Connections

Constructing objects manually stimulates the most creative part of the brain. This technique helps people express thoughts that are hard to explain in words. Moreover, it forces them to be more precise about their ideas. Although some people tend to think that they may have difficulties in creating 3D models, participants built in thirty minutes very expressive prototypes.

Analysis

After the workshops finished, the project team worked hard on the analysis of all the generated data. All workshops were recorded. We had videos, collages, low-tech prototypes, photos and information that collected in situ. To evaluate them, these techniques were used:

1. Video recording: All the videos were transcripted. We were able to evaluate the topics that had been more relevant for the participants.
2. Semantic analysis: The meaning of each dialogue and presentation was analyzed.
3. Affinity diagram: We organized ideas and their expressions to find the correlations and identify valuable categories. This technique made sense of expressions by clustering subjects.
4. Word clouds: To better visualise the results of the topic clusters word clouds were created and analyzed. After a couple of weeks, we came out with 5 topics changed by the Internet: memory, connections, work, travelling through time and space and security.

Design brief

From the analysis of the information provided by users and using the constraints about the integration of contemplative, interactive and participatory aspects in the possible exhibits, we prepared a design brief for each topic. Each brief was had six sections: Inspirational anecdote, Science and Technology concept, a sample proposal for the exhibit (volunteered by the team and inspired by the 3D models coming out the sessions), contemplative aspect, participatory aspect and practical technological support. Visit Tech Virtual to see how all these aspects were bundled together in the briefs.

Virtual design

Design briefs were shared on Tech Virtual with a wide community of users who were encouraged to design their own final exhibits fro them. Construction of the exhibits was done virtually in the Second Life virtual world island that the Tech Museum set up for the project. A design contest was open to users in the entire world. It was not a regular competition where the most important factor is the prize and contestants must keep their work secret until the end. It was based on collaboration between designers, dialogue and multiple contributions.

We organised regular weekly virtual meetings in Second Life. Every Thursday we met at 7pm Spanish time, 10am California time, and waited for user avatars to show up in the design space. There were around 10-20 avatars. Participants discussed how exhibition proposals could be improved or the work that had been done during the previous week. Other days, we saw how a new exhibit was created in real time and there was a general interchange of comments on what the co-designers thought about it and the hows and whys of some details were also asked.

Selection

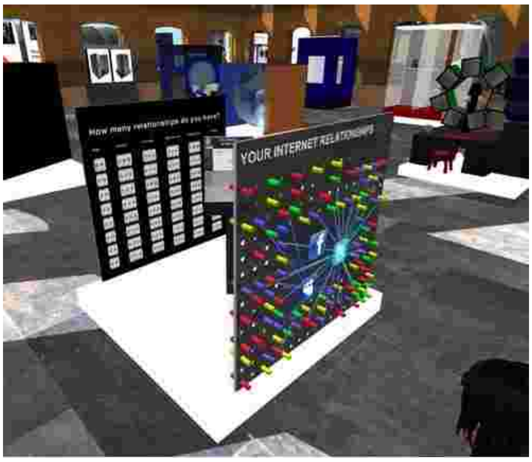

Figure 2. Connexions, the winning exhibit

Up to this point the process had gone through three phases: a first, generative phase, were co-designers explored ideas and used metaphorical 3D prototypes to express what exhibits were to be about and how they could look like; a second, synthesis, convergent phase where design briefs were elicited and, then, a third phase where, again, divergent thinking was expressed by co-designers in the creation of several proposals for each single design brief. There were 15 proposals from people all over the world: USA, England, Vietnam, Spain, etc. After the contest closing date, on April 2010 7th and 8th, there was an on-line and off-line poll. People all over the world could vote for their favourite proposals. The first prize was for Maria Bobes for her “Connexions” proposal. There were four more selected exhibit designs. These were taken as the ones to be used for the final exhibition.

Final exhibit blueprints

The project management team took the virtual design and then it checked it for design requisites. Last final steps to ensure visual coherence of the whole exhibition, that is, design in its more aesthetic sense. A final translation from Second Life structures into actual feasible exhibit blueprints was performed. That required some decisions about materials, colours, and some solutions that would work in a virtual setting but not in a physical one in a real museum. The virtual blueprints were complemented with measures to make it easier to actually build them. All this was compiled into a document that can be find at the Co-Creating Cultures website (25).

Discussion and Further Work

The first question we posed ourselves was if it were possible for non-experts to design a quality exhibition about Science and Technology subject. The process showed that it is actually possible for people to create such an exhibition. As to quality, measurement is always difficult and subjective but experts on exhibition design were surprised about the quality of the designs created by participants. Also, the project was one of the reasons for the Tech Virtual receiving the 2010 Linden Prize, which may be a hint of quality.

Interestingly enough, the subjects selected in several sessions by people from very different backgrounds were almost always the same: social relationships (connexions), memory (photography), time and space (instantaneity), work patterns, and security. These were in most cases associated to technology and science. Social relationships and its expression in network science were consistently chosen in all sessions offline and online. Users were actively and enthusiastically involved in the process. From qualitative research based on interviews we saw that their most cited reason to participate was “doing something different with people” and “learning new things”.

Multiculturalism seems not to have been a problem, but added to diversity and creativity in mixing different points of view. One could also see a high variance in aesthetic renderings of the same design brief.

The methods that we used from design and co-design strategies were useful to a point and had to be adapted in later workshops in order to make easier for participants to reflect on the involvement and reaction to the overall design by other users. The combination of online and offline collaboration workshops resulted in different publics involved, with some overlapping. Online publics were more global and more technology oriented than the ones attending face to face sessions. One can get local involvement and global reach in this way. The combination of online and offline approaches also pointed to further work on replicating design methods online, so that you can get similar dynamics to face to face sessions but with larger groups online. This, however, requires extensive research on the translation of collaborative design sessions and it will involve further technological and interface design research projects, which are currently being defined.

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Taking Science to Common People– A Technology Approach

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Abstract. An attempt is made to take science to common people for developing a scientific temper, humanism and spirit of enquiry. This has to be done in micro as well as macro level for coordinating efforts amongst various scientific bodies, academic institutions, industry and NGOs for the effective exchange and dissemination of scientific information. The science communication programmes should undertake activities including training courses, lectures, audio visual and folk media. With limited resources and multitude of languages, mass science education faces great challenge in delivery and coverage. Due to the paucity of resource persons we are not able to reach the large part of rural mass . Simultaneous coverage of larger audience in one go and mass coverage of people in the remote areas for spreading science literacy, are more complex and difficult.

To resolve the challenges of mass reach, interactive communication model with easily implementable and adaptive approach with broadband technology was tried in BSNL for employees' training delivery. The success story has been brought out as model for the spread of science communication across India.

A server with streaming card and web camera at the headquarters (called Web studio) were connected on to the broadband internet. The server was connected to audio amplifier and a mike was used for broadcast .The server was configured as web server with a website having a small window presenting the resource person video and an application for on line chat and interactivity. This server having hooked on to the broadband network was made available at remote locations having broadband connectivity. The programmes were preplanned and the remote locations were informed beforehand. On the day of programme the resource person will be conducting the lessons at the webstudio. In the remote location the audience will be sitting before the computer connected to the broadband internet logging on to the website through which the current programme is being streamed. This was having interactivity and coverage to all remote hill areas where BSNL persons are stationed and who require training on customer care initiative and technology awareness programmes. This initiative was an all round success on account of the broadband internet presence everywhere , attraction of video impact of the resource person and coverage of BSNL training programmes to thousands of employees in a shorter span of time with cost effective training content.

This cost effective model can be deployed to resolve the need to make science communication activities more effective, both in terms of quality and quantity. By this mode of communication we can make a dent in wiping out superstitions that have prevailed throughout the ages, particularly in tribal areas where literacy levels are low with the help of Self Help Groups and Common Service Centres. Thus great and complex challenges in mass science education can be met with success.

Entrepreneurship Development Programme through Science & Technology: A Case Study of Uttarakhand Council

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Abstract. Uttarakhand is a hill State with 93% of the geographic area as hilly terrain and 64% is covered by forest. Its far flung areas are under-developed with bad connectivity to the cities. The development of the remotest place with roads, water, electricity, education, opportunities and dissemination of Scientific and Technological knowledge to the population is expected from the Government of this newly constructed State. In this endeavor of State Government the Uttarakhand Council (a nodal agency of DST, GoI) plays catalytic role for the promotion of Science and Technology in the State and supplement/complement the developmental programmes of the State. In this direction the Council has started multiple programmes with Science Popularization and entrepreneurship development programmes as one of the mandates. Since 60% of the population of State depends on agriculture, entrepreneurship programmes related to food processing, canning and technology development for farmers is an important small scale enterprise. With this in focus, the Council has established 06 Training Research Centres. These Centres act as source for technology dissemination and training of local people to start small enterprises related to processing of fruits juices, vegetables, pickles, fish rearing etc. Beside these, some region specific flowers and herbs are available, whose juices are in high demand. So training to extract and preserve these juices by scientific methods is provided by these TRC's with their sustainable use. This will not only help farmers to generate an alternate source of income but also provides a way to preserve the perishable items at the source point itself. Along with this the Council has one district coordinator in every district. These district Coordinators are pillar of strength to the functioning and outreach of the Council in remote areas of the State. Through these coordinators the science popularization programmes, technology dissemination programmes, EDP programmes are reaching the far flung areas. These activities has greatly enhanced their economic condition. Under these TRC's around 12,000 beneficiaries have been given training and are working successfully in the small scale enterprises. Another point to mention here is that these Centres heralds development of improved technologies based on locally available natural resources and improvement of post harvesting techniques with traditional experience and knowledge for commercial requirements. These TRC's further gain importance owing to their local nature. Since they are located in villages they are able to identify the local needs and hence to provide solution and training for that with the scientific inputs. Since its inception, Council has successfully organized more than 40 entrepreneurship development training programmes throughout the State and have established one Mangal Turbine to solve problem of drinking water, ropeway for connectivity of hilly regions and started River bank filtration projects for providing drinking water in five towns of Uttarakhand.

The paper deals in detail the various initiatives taken by the Council to develop human resource in the State for generating revenue to the farmers in addition to their farming income, entrepreneur development programmes for setting up region specific small scale enterprises and dissemination of scientific and technological knowledge among the masses. In conclusion, we can say the EDP has greatly enhanced the technical human resource of the State and hence economic upliftment of the farmers with development of scientific temper.

Role of Science Centers & Science Museums

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Abstract. Science museums have been one of the important means for popular citizens to acquire scientific knowledge. The importance of this matter is undoubted. With times going, especially the Internet's coming, people can gain the scientific knowledge in more and more multiple ways. So it is very urgent to allocate the role of science museums, in specially, the large-scale ones in the science popularization.

Through such items as the advantages and disadvantages of science museums compared with other media, and the difficulties in the internet, and the efforts made from various places, the paper attempts to discuss how the science museum make maximization of its whole function and intensification of the cost in the process of popular science and make it keep on playing an important role in science popularization in new era.

Keywords: Role science museums

Discussion on the social role of China Science and Technology Museum

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Abstract: With the social progress, public demand for science popularization is getting higher and higher. As an important national science popularization infrastructure, China Science and Technology Museum is facing unprecedented opportunities and challenges. To meet the requirements of the times, continuously strive to raise the standards of our works, and achieve sustainable development, we must accurately locate its social role. Firstly, this paper analyses the goal, features and functions of China Science and Technology Museum. As a non-formal educational institution, China Science and Technology Museum aims at propagating scientific knowledge, disseminating scientific spirit and methods, and promoting scientific thoughts and concepts. It is open, participatory, situational, educational, scientific and interesting for the public. And it has such three basic functions as educational function, service function and support function. Secondly combining with practical work, this paper turns to explore the social role of China Science and Technology Museum. In general, China Science and Technology Museum should be located multiple roles, the explanation is as follows: (1) The disseminator of science knowledge. Propagating scientific knowledge is fundamental function of science and technology museum, China Science and Technology Museum has been developing diversified educational activities on top of perfecting the standing exhibition in past over 20 years, so it is a lifetime classroom for the public. (2) The guide of scientific interest and scientific concepts. Disseminating scientific spirit and methods is even more important than propagating scientific knowledge. With a series of activities, China Science and Technology Museum make public have a good command of science method and skills, and understand the scientific spirit and humanistic spirit. (3) The communicator between the public and the scientists. China Science and Technology Museum tries to encourage technological and cultural exchanges between the public and the scientists, so as to promote the voluntary participation and foster social responsibility of the public. (4) The partner and supporter of other educational systems. Science and technology museum is a useful supplement and extension for school education, China Science and Technology Museum is not only a good place to study for students, but also a helpful place to attend scientific and technical training and improve their ability for teachers. (5) The vanguard and service provider of local science and technology museums in China. China Science and Technology Museum should provide a series service such as consultation and guidance for the local museums. (6) The theory research center for the science and technology museums. Academic research is beneficial to develop high degree of exhibitions and activities, and achieve an advanced class in the world. (7) The collector and exegete of historical collections. As a national museum, China Science and Technology Museum has the duty to preserve and present the historical collections, and promote national science and culture history.

Keywords: China Science and Technology Museum, Science popularization, Social role

Biodiversity Conservation Academy: Inspiring South African Undergraduate Science Students to Postgraduate Studies and to Careers in Research Science

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Abstract. The Biodiversity Conservation Academy is a venture by two South African centres of excellence, the Centre for Invasion Biology and the Centre for Birds as Keys to Biodiversity Conservation (based at Stellenbosch University and at the University of Cape Town respectively). The aim of the academy is to mobilize, motivate, and mentor undergraduate science students, particularly those from previously marginalized groups (e.g. black South Africans and women) to take on postgraduate studies and to consider careers in research science.

The South African research landscape is such that most research work is carried on old white shoulders, white males majority of which are nearing retirement age. There is not much involvement of other population groups, although the contribution of diverse communities like we have in South Africa can provide a rich diversity of thoughts and perspectives that are sometimes necessary to resolve complex research challenges. However there has been a great deal of optimism among the South African research community from the time when South Africa got its first democratically elected government. This optimism was matched by the reform in the country's education system which was expected to unleash a pool of talented students who were denied opportunities during apartheid. Although those working in higher education in South Africa have recognized that not many students graduating with Bachelor of Science degrees are enrolling for postgraduate degrees at Master's and Doctoral levels especially in the whole-organism biology. Part of the reason for this situation was identified to be the lack of emphasis on field biology (or research) in the undergraduate curriculum and the lack of understanding career options open to whole-organism biologists.

The Biodiversity Conservation Academy is designed to address such shortcomings. It provides undergraduate science students with skills required to tackle research problems, introduce them to current theoretical, practical, and philosophical issues in Biodiversity Conservation, and inspire them to consider science research as a career. Emphasis is placed on Biodiversity Science as this is an area of natural advantage for the country. The combination of our moderate climate and land ranges gives South Africa some of the world's most diverse animal and plant life (the laboratory in our back yard), and this means that South Africa has a potential to become a catalyst for scientific progression throughout Africa if we give priority to research areas where we have a natural advantage (e.g. Biodiversity Science).

This work demonstrates how the Biodiversity Conservation Academy mobilizes students from across South Africa into a biodiversity hotspot area in the Western Cape Province of the country to sensitize them to the importance of biodiversity and to issues of conservation and thereby contributing to building the new face of the scientific scholars not only in South Africa, but in the entire continent.

Promoting Science at School Level through hands-on Experiments

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Abstract. Over the last decade, it has been observed that there is a great decline in the interest of students in pursuing science across the country. After finishing their graduation in science, students tend to go for MCA/MBA instead of pursuing a career in science. The chief reason for this decline is that they don't get the required motivation/drive due to the conventional manner in which the science is taught. The same is reflected in the India Science Report prepared by National Council of Applied Economic Research (NCAER).

As per the student's perspective:

1. Students don't find science education motivating
2. Equipment used is obsolete
3. The number of students in the class is too many to understand what is being taught in the class.

As per the teacher's perspective:

1. Inadequate practical training
2. It is a costly and difficult education with limited job opportunities

Therefore, there is a great need that students are exposed to various hands-on activities to develop interest in science starting at the school level itself. Recently, University Grants Commission (UGC) has sanctioned a research project "Investigating science hands-on to promote innovation and research at the undergraduate level" in which the undergraduate students are working on various sensors and data acquisition systems for carrying out experiments in Physics, Electronics, Biology, Chemistry and Biomedical Sciences. As part of the extension of the project, the experiments developed will be demonstrated at various schools. Therefore, students at the school level will be able to carry out various basic to advance level experiments through hands-on using various sensors like gas sensors, conductivity probes, pH probes, charge sensors, current sensors, light sensors, magnetic field sensors, drop counters, dissolved oxygen sensors etc. and data acquisition system LabQuest.

Therefore, it is envisaged that the above studies will be useful as under:

1. It improves students' understanding of various science concepts.
2. It provides free class time for student engagement in higher-order thinking skills such as analysis, synthesis and evaluation.
3. It encourages inquiry based laboratory activities.
4. It enables students to perform new experiments with measurements which were earlier not possible in the practical laboratories.

China Popularization of Science and Technology Infrastructure development and trends

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Abstract. In 2009, for the first time, China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China's PST infrastructure development status. Firstly, the author studied and established the overall evaluation index system for China's PST infrastructure development and six separate assessment index system for each category of PST infrastructure. Secondly, by using these evaluation index, Monitoring and evaluation on PST infrastructure was carried out and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status was obtained. At last, a series of further analysis on both successful case studies and reasons for major problems were conducted, and then the Author proposed several solutions on relevant issues. On The basis of this study, Report on Development of China PST infrastructures in 2009, as the first annual report, was completed and officially published. These results can not only lay a solid foundation for annual monitoring and evaluation of China's PST infrastructure project in future, but also provide policy making support for accelerating China's PST infrastructure construction. And the author believes this research will be a precious reference for other countries and regions in PST infrastructure development.

Keywords. Popularization of Science and technology (PST) Infrastructures, development status and trend, monitoring and evaluation, index system

Introductions

'The science and technology achievement can play fully use for social development, only if it was grasped and applied by the whole society'.[1] This statement is exactly a description of popularization of science and technology course itself. According to a society survey in US, formal education is the main pattern to build up people's science literacy [2] .People are bound to leave school sooner or later, while the development of science and technology is permanent, hence PST infrastructure provide an efficient platform for people's lifelong-study and promote science literacy. By the fully application of all sorts of PST infrastructure, the lay public can learn S&T knowledge , grasp S&T methodology , build up a Science belief and maintain Science faith , then enhance their own science literacy , and finally promote their capability on dealing with practical problem and participating in public issues. Moreover PST infrastructure founds an important base for PST work, being the key component in the entire public service system and construction of national PST capability. [3]

The popularization of new S&T achievement among the society and promotion of public science literacy are all depending on the national PST infrastructure's widely construction, fully application and sustained development. To get the overview of the development status in China then to provide policy-making consulting for PST infrastructure's sustained development on macro-level view,2009 China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China's PST infrastructure development status. Firstly, the research group established an evaluation index system for China's PST infrastructure development. Secondly, by using this evaluation index, the research group carried out a series of monitoring and evaluation work and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status, best-practice experience and shortcomings was finally obtained and relevant policy suggestions were brought out. On the basis of mentioned findings, CRISP complied and published a formal research report:"PST blue cover book·PST infrastructure development report in China of (2009)" [4].At last, by combinative analysis of 2009 and 2010 surveys, the author analysis the feature of each category of PST infrastructure development, summarize the main problems and predict the development trend of PST infrastructure development in near future.

PST Infrastructure Development Status in China

Currently definition for PST infrastructure in China

What is PST infrastructure? So far, there is neither a specificity research focusing on the definition in PST theory field , nor a university acknowledgement in both China and abroad on the content of PST infrastructure. The author is not to launch a discussion on the definition and content on PST infrastructure, but to extract main problems from Chinese PST infrastructure development presently on a practical view. According to"PST infrastructure development strategy（2008-2010-2015）" [3], the majority of PST categories in china is including: science museum, grass-root science facilities, online facilities and other popular science education venues (such as the popular science education base).

Science and Technology Museums are those museums that are main means for the public to carry out the main function of science education and display natural sciences and engineering sciences and agricultural sciences, medicine and science content mostly the museum. Including the Museum of Science and Technology (Science Centre), Natural Sciences Museum (Natural History Museum, Planetarium, Geological Museum, etc.), engineering (professional) S&T Museum and so on.

Online science facilities (Digital Science and Technology Museum): mainly refers to the use of modern information technology, integration, development of science-related network resources to the Internet as a platform for the public on the popular science education infrastructure. Those are including a number of science museums, science websites, science channel and other comprehensive sites.

Basic science facilities: the main means of counties (cities, districts) and towns (street) and village (community), and other science within the show, to carry out science activities science venues (by). This kind of science facilities are including the popular science activity stations (center or activity room), community school science, science parks, science bulletin boards (Science Gallery), science caravans and other facilities.

Others（PST education bases）：Relying mainly refers to the teaching, research, production and service institutions, which open for society and the public with specific science and technology education functions. Including cultural centers, Youth Palace and other cultural, educational venues; Zoo, Ocean Park, forest parks, nature reserves and other natural features with S&T education, history, tourism and other public places; research institutions and universities, laboratory, showroom or research centers, astronomical and Meteorological observatories, field observation stations; enterprises, rural and other production facilities open to the public (or processes), technology parks, exhibition halls, etc.; the other S&T education organizations or facilities which open to the public.

As one of the main science infrastructure in urban area,S&T museums are the cities' service center for S&T communication.S&T museums usually has relatively large scale, obtain ambulant science education resources and hold important positions among all sorts of PST infrastructures. As for the distribution of PST in China, PST infrastructure mainly locate on the grassroots level, these so called basic science facilities, with small construction scale and huge amount, played a "moisten things silently" role at the grassroots level for science popularization work. While online science facilities as a rising star, is developing rapidly, become the new force of PST infrastructure's construction and development. Other PST facilities (such as 'science popularization education base') are helping make full use of social resources of science facilities, play an important complementary and supporting role for PST construction and development.

Development status of PST infrastructure in China

Overall, PST infrastructure experiences a good momentum of development, undergoing a new wave of construction boom. According to recently survey, the PST infrastructure emerged as a rapid development trend on both form and scale aspect, with further expanding the scale of public participation.

Science and Technology Museum has become a more reasonable communication system, with scientists, engineers and the public stand on an equal exchange and communication platform. According to incomplete investigation by the research group, there are 582 Science and Technology Museums in China currently. Among them, there are 267 comprehensive S&T Museums, 122 industrial S&T Museums and 193 Museums of Natural Science. A diversity and wide range museum system has been formed, which is including Science and Technology Museums, Museum of Natural Science, Industry Science and Technology Museum (such as transportation museum, telecommunications museum, railways museum, geological museum and agricultural museum, etc.).

On national level, China now has one national comprehensive S&T museum, 33 Industrial Science & Technology Museums, 66 Museums of Natural Science. On provincial (ministry) level, there are 29 comprehensive Science and Technology Museums, while there are only three capital cities without a comprehensive Science and Technology Museum. There are 37 Industrial Science & Technology Museums and 53 Museums of Natural Science 53 on provincial level. As for prefectural (city) level, there are totally 128 comprehensive Science and Technology Museums, 30 Industrial Science & Technology Museums and 43 Museums of Natural Science. 109 Comprehensive Science and Technology Museums, 13 Industrial Science & Technology Museums and 23 Museum of Natural Science were built on county level.

According to the introduction of the "Science and Technology Museum building standards"[5], There are 9 especially large-scale comprehensive Science and Technology Museums, 18 large-scale integrated Science and Technology Museums, and 26 medium-scale comprehensive Science and Technology Museums. In 2009, there were about 30.2 million people visited permanent exhibitions, and about 670 million visitors visited temporary exhibition. However, there is still no comprehensive industry science museum in china and the gap between construction speed of Science and Technology Museums and pace of urbanization stays obvious.

Basic science facilities are divided into two major categories as fixed and mobile science facilities, which is constructed according to local conditions, flexible development and distributed throughout urban and rural areas. Fixed science facilities including the science activity stations (center or science activity room) located through streets, communities and towns, science schools, science parks, agricultural science service stations, science information stations, popular science bulletin boards (popular gallery) and so on. According to recently statistics, there are more than 270,000 science activity stations with the site area of more than 11 million square meters; 32 million science bulletin boards (Science Gallery), with a total length of over 2.1 million linear meters; over 2000 electronic bulletin boards science (Science Gallery), which can last more than one million hours. Current science facilities included science caravans, popular science show cars and other mobile facilities for science advocacy services. So far, the existing mobile science facilities in China include more than 1,400 vehicles and 270 science popularization caravans which are dispensed by CAST.

By the end of 2008 [6], there were totally of 1899 science popularization websites were built in China. According to the findings from a consecutive 3-months real-time monitoring conducted since March 2009 by Online Science Popularization Alliance, there were 600 online science popularization websites and 90% of them were running well [4]. Online science popularization concerns to more than 50 subjects, including mainly 5 fields as: natural sciences, agricultural sciences, medical sciences, engineering and technological sciences, humanities and social science. The founders of online science facilities are mainly composed by social organizations and Associations for Science and Technology on all levels. At the meantime, individual science popular websites got rapid development, science blog has become an interactively network for public participation in science and technology.

Science education bases in China mainly refers to the ‘popular science education base’ and ‘youth science and technology education base’, a ‘pyramid’ type framework has been formed among national, provincial, and municipal and county-level. There are more than 800 state-level science education bases, around 2,000 provincial science education bases, and more than 10,000 built on prefecture-level and county-level (without double counting, only the highest level of a complex statistical). The number of the popular science education base s in eastern part has accounted for more than half of the total number in the whole country, and the vast majority of the popular science education bases were built by high-tech enterprises, universities and research institutes.

Main Problems Facing the Development of China's Science Infrastructure

Although the PST infrastructure in China has achieved a good development, but at the same time, PST infrastructure development still can’t meet the public demands on science and culture in the whole country.PST infrastructure’s healthy development is faced with many problems and bottlenecks, such as funding, policy issues, human resource and science resources shortage. To sum up, all of those problems mainly located in the following two aspects.

Balanced development

At present, China PST infrastructure is not only faced the problem of insufficient volume, but also faced the problem of imbalanced development. Shortfall can be solved with the development ,while if imbalanced development cannot be controlled and get a overall planning, these problems will persist and may become worse, resulting in uneven distribution of resources and coursing waste.

Balanced development has two aspects: regional imbalances and imbalanced development inside PST infrastructure framework itself. Imbalanced development can be divided into a nationwide problem of regional imbalance development and an imbalanced development in local area. Imbalanced development across the country is mainly due to the impact from local economic development difference. PST infrastructure development of eastern part of China present significantly better than central and western region.

Almost half of the country's PST infrastructure was built in eastern region, for example, over half of S&T museums were built in eastern China, but in western provinces such as Tibet and Gansu even in their capital cities, there is not any comprehensive S&T museum so far. (Hainan didn’t have as well).that do not have a comprehensive Science and Technology Museum (Hainan did not.) Imbalanced development within the local area is that within the administrative divisions at the provincial level, prefectural (city) and county levels, large, medium and small scale S&T museums should maintain a balanced portion with development. On the basis of "Science and Technology Museum building standards", there are some cities built several large-scale Science and Technology Museums. Among different provinces, areas with better economic development are better than areas poor economic situation, and urban areas are better than rural areas.

China Science and Technology Museum construction has been prominent imbalance. Data shows that there are more Museums about Science class, while pharmaceutical museums and agriculture related museums are less than normal. There are only 8 comprehensive National Museums of Natural Science , the ‘true ‘planetarium is only one, and so far there is not a comprehensive science industry museum in China can play an important role in the history of museum development in the world.

Sustainable development

Sustainable development for PST infrastructure is to concern about the problems occurred during the sustainable development of PST infrastructure, including policy, funding, human resources, PST resources , operation strategies and management system. According to the result of investigations, almost the entire PST infrastructure is faced with a sustainable development issue.

S&T museums in China were mostly built in last century. Most of the S&T Museums in China cannot display their full effect. How to make these venues to re-revitalize and maintain sustainable development has already become a problem to carry out the work of the current science popularization problems. At the same time, Science and Technology Museums are built newly or under construction, by past experience (if you do not correct past practice), will soon follow up and face with the sustainable development issues. Among all these issues, the primary problem is the lack of fund, and then the problem of insufficient PST human resource, operation strategies, management system and public regulation also can impact the sustainable development of PST infrastructure.

Compared to museums of Science and Technology, the popular science education base, grassroots science facilities (including the science popularization caravans), online science facilities are all faced with the problem of sustainable development, and the problems are still pointing to fund, science human resources, operation strategies ,management system and regulation.

Because there is no associated financial and policy support, science education base are reluctantly or difficultly to carry out science popularization services, that cannot result in ideal effect. As for primary funding status for the operation of PST facilities, some sectors can barely maintain to carry out normal science fares, very few sector can guarantee the sustainable development of their PST facilities, which including training and supplement, exhibits designing, updating and maintenance and so on. Take western regions with poor economic situation for example, even the cost around 100,000 a year to maintain the PST caravans; it is still difficult for the science education base to guarantee. On most occasions, and it depends on the personal ability of managers to find ways to raise funds, as much as possible to carry out science activities.

PST infrastructure Development Trend in China

According to 'Popular Science Infrastructure Development Plan (2008-2010-2015)' and currently development trend, Chinese science development trend in the future of the infrastructure are as follows.

PST infrastructure construction continues growing, to reach a relatively rational layout for PST infrastructure in China as a whole

The government should play a leading role in PST infrastructure construction, and an overall strategic plan on national level need be strengthen.

First of all, the government is trying to build up a rational layout for S&T Museums in different region of China. In municipal region and some counties which already obtained necessary conditions, a number of S&T museums with specialized themes, topics, and other distinctive factors are encouraging to built by government; Some qualified research institutions, universities, enterprises and small towns ,which has vital resources or local priority conditions, were asked to construct a number of professional development (characteristics) or industrial technology museums; To take full advantage of major construction projects or idle enterprises belong to state and out of used production facilities, some industrial technology class museum will be constructed in future.

Secondly, the government will further promote Research institutions and universities open to the society to carry out science activities, promote Youth Palace, women and children activity center, parents-schools, culture palaces to add more science popularization content during daily service, encourage qualified enterprises to open their R & D departments production facilities (process) or Exhibition Hall to the public and to establish science sites; guide aquariums, safari parks, theme parks, nature reserves, forest parks, geological parks and zoological gardens to enhance their science education functions.

Thirdly, the government will promote the construction of county-level integrated science venues, which can provide PST education, training, exhibition , and other PST service, across all of the country's counties (cities, districts) . Rooted in full use and integration of existing resources, the government have the plan to make more than 60% of the streets (township), communities (villages) can obtain a science activity stations (rooms), Popular Science Gallery (bulletin boards) will cover 60% of the communities and villages, and the S&T promotional content updating more than 10 times within a year; to increase popular caravan allotted number to 1,500 vehicles, and cover all of the prefectural (city, state) and the conditions of the counties (cities, districts); to press some qualified primary and secondary schools to built more conditions to establish Youth Science studio by use of existing education and training establishments .

The service performance of PST infrastructure infrastructures increased significantly and the opportunities for the public to promote their science literacy are of significantly increased as well

Full play the leading role of the government, from national level to strengthen the infrastructure of science to run the macro guidance. In accordance with "Science and Technology Museum building standards," do not have the development of education can not be fully functional or the role of science and Technology Museum renovation necessary; research infrastructure to develop science standards, identify measures, management regulations and monitoring and evaluation system, regularly carry out monitoring and evaluation, science by strengthening the infrastructure management to enhance overall service capabilities.

A substantive–development indemnify system of PST infrastructure was established

Relevant policies, regulations, fund, organizations and implementation, are all important guarantees to mobilize all social forces devoted into the development of PST infrastructure. Government should implement the state's relevant regulations and policies accompany with the further formulation PST institution system, improve the public PST infrastructure management system and operational mechanism to strengthen the operation management of PST infrastructure. The PST construction plan should be put into the national economy and social development overall plan accompany with the increase the portion of public input on PST facilities construction and operation fund. Put efforts to concretely carry out the existing tax incentives, to encourage enterprises, social groups and individuals get involved in PST infrastructure construction and operation management.

Conclusions

(1) Briefly introduction on currently main types of PST infrastructure in China and the definition for each type was given.

(2) A comprehensive and detailed analysis on development status of different sorts of PST infrastructure. According to data from recently survey, PST infrastructure has made significant achievements in China.

(3) Two subject matters are the balanced development and the sustainable development for PST infrastructure in China.

(4) Forecast for the development trend of PST infrastructure in China.

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'H5N1–The Evolution of an Influenza Virus', A Study Into the Effects of an Exhibition and an On-Line Serious Game

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Abstract. Research question: Can an exhibition and an on line serious game contribute to knowledge and attitude with a general public about the threat of an avian influenza virus causing a human influenza pandemic? In an explorative study, the authors compare the effects of an exhibition and an on line game, by measuring knowledge and attitude of participants before and after visiting the exhibition or playing the game. People's attitude toward animal experiment was also examined.

Introduction

On the occasion of the Darwin Year 2009 Erasmus MC, University Medical Center Rotterdam and the Natural History Museum Rotterdam organized the science manifestation 'H5N1 – The evolution of an influenza virus', which was about the continuous mutation of influenza viruses and the threat this causes for human health. The manifestation consisted of an exhibition in the museum and an on line serious game on the internet (www.thegreatflu.com), and lasted from February 11 until October 25, 2009. The manifestation targeted the general public and focused especially on pupils in the highest classes of secondary education (15 to 18 years old).

The manifestation opened on February 11, 2009. One month later the world was shocked by the emergence of the H1N1 Swine flu virus, which officially led to an influenza pandemic and dominated the news media for almost the rest of the year. This coincidence of the pandemic and the manifestation generated a lot of public and media attention for the exhibition as well as for the on line game. Especially the on line game was featured by news media worldwide, which in turn attracted unexpected high numbers of players. Up to date, more than 400,000 players from over 70 countries in the world have been playing the on line serious game. 17,500 people, mainly from The Netherlands, have visited the exhibition.

However, this coincidence also influenced the study both authors have been conducting into the effects of the exhibition and the game. On one hand the theme proved to be unexpectedly topical during the period in which the study was planned, resulting in an enormous amount of visitors. Thanks to this, more than 3,000 people completed the first questionnaire of the survey on the homepage of the game. On the other hand, news coverage on the pandemic appeared to be very similar to the content of the exhibition and game, which makes it hard to determine whether effects measured by the study were caused by the exhibition and game or by the attention given to the pandemic in the news media.

Methods

This study measured the effects of the exhibition and the on line serious game by conducting a questionnaire among visitors of the exhibition and players of the on line serious game, before and after their visit or game. The questionnaire consisted of 18 questions from demographics to biomedical knowledge, related to the subject of the manifestation, as well as attitude of the respondents towards science and related (ethical) questions, such as animal experimentation and vaccination.

Conclusions

New media applications, such as on line serious games, can attract new audiences but must be carefully targeted if specific target groups have to be reached. Both exhibition and on line serious game seem to have an effect on knowledge and attitude of participants, although the effects of the societal context should be taken into account. The attitude of the public towards science in general is both realistic and positive. The attitude towards methods of science and policy recommendations based on scientific research is critical.

Global and Local Knowledge Shown in Science and Technology Museum–Practice in China

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Abstract. After re-attracting world's attention by shining economic growth, Chinese curators in science and technology museum propose to reshape the image of China in historical river. Hence it is unavoidable to deal with the relationship between knowledge of localization and of globalization. The paper attempts to describe and analyze the practices in which the Chinese expressed their thought and sentiment in the science and technology museum.

Each of the localized knowledge of China is global knowledge network node, no matter in space or academic genealogy. Modern science and technology always looks alike globally, the traditional Chinese science and technology and their application all over China reflect the side of localization. In recent thirty years, science and technology museum in China become increasingly active in the formulation of the relationship between these two.

The paper presents multiple practices covered by 7 science and technology museums, including China Science and Technology Museum, Beijing Museum of Natural History, Beijing Museum of Traditional Chinese Medicine, Beijing Planetarium, Geological Museum of China, Shanxi Science and Technology Museum, Dongguan Science and Technology Museum, then summarizes several ways of combing globalized knowledge and localized knowledge together commonly used by Chinese curators, such as chronicle, communication, and Whiggish history. Furthermore the paper focuses on study a number of exhibitions and sections of science and technology museums in China with museology. It covers how to bring brilliant but controversial tradition of scientific and technological knowledge into global knowledge systems; China's division of work in global knowledge creation; how to express the tension between localization and globalization; how to avoid incommensurability between modern knowledge and non-formal knowledge; how to show the global influence of localized knowledge in science and technology museum properly, etc.

This paper summarizes the advantage and disadvantage when presenting localized knowledge and globalized knowledge in science and technology museum, and suggests related solutions including where to combine localized knowledge and globalised knowledge, how to combine and how to ensure the best effect of science communication.

Finally this paper gets the root cause why exhibition designer could not well handle the relationship between localization and globalization. The reason behind is the exhibition designer does not understand exactly the position of the object to be displayed in the coordinate system of science and humanities, neither for in the history of science. The topic of the localization vs. globalization actually is the reflection of the field of science and technology museum, which is raised by C. P. S now of 'The Two Cultures' problem: the split between scientific culture and literary/humanistic culture.

Development of Interactive Science Communication Lecture for University Students

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Abstract. The interactive lecture was developed so that the university students may think about the relation between the science and the society. About 150 university students discussed, and expressed their own opinions about themes of genetically modified organism, a global environment, an up-to-date science technology, and bioethics, etc. It is important how science course students get social literacy and how researchers explain their research to the society. However, such a lecture was few up to now. Through this class, we can provide valuable chances to think about advantage/disadvantage of cutting-edge science.

A Study on Applying Knowledge Management to Improve Science and Technology Communication Effect of Chinese Science Centers

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Abstract. Main factors that affect science and technology communication effect of science centers include communication subjects, communication content, communication techniques, organizational publicity and audience quality. On the basis of introducing the meaning, role and actual application of knowledge management, this article demonstrates that through implementing knowledge management, Chinese science centers may raise the work capacity of exhibit designers and educational activity planners and organizers and the management level, organizational publicity level and audience service level of the science centers, thus improving the communication content and techniques of exhibits and educational activities, perfecting organizational publicity work and ultimately achieving the goal of improving science and technology communication effect. In the end, this article discusses the key and difficulty of science centers in successfully implementing knowledge management and suggests that science centers implement knowledge management as early as possible so that science and technology communication is carried out in a better way.

Keyword: Knowledge management; Chinese science centers; Applied research

Foreword

In recent years, with the fast growth of Chinese economy and the high attention paid to science center undertakings by the governments at all levels, the construction of science centers develops rapidly in China. From 2000 to now, tens of science centers have been built up and opened and some science centers have been rebuilt or expanded. Particularly, under the vigorous support of the governments at all levels, the hardware facilities of science centers are upgraded significantly and some science centers have reached international advanced level. For example, Guangdong Science Center completed and opened in September 2008 with a construction area of 138,000 m^2 is the largest science center so far in the world. For another example, the new premises museum of China Science and Technology Museum completed and opened in September 2009 has a construction area of 102,000 m^2 and Shanghai Science and Technology Museum completed and opened in December 2001 has a construction area of 98,000 m^2. Under such good situation, how to further improve science and technology communication effect and meet public demands on science popularization in a better way has become an urgent problem that science centers need to think over and solve.

This article believes that drawing on the experience of domestic and foreign enterprises and public institutions in the implementation of knowledge management, the implementation of knowledge management in science centers helps the science centers improve science and technology communication effect and fulfill their mission in a better way.

Meaning and Role of Knowledge Management

Meaning of Knowledge Management

By implementation subject, knowledge management may be usually classified into organizational knowledge management and personal knowledge management. Organizational knowledge management regards knowledge as an important resource and raises the management efficiency, adaptability to changes and innovation ability of an organization through knowledge storage, acquisition, sharing, use and creation to ultimately realize the goal of enhancing the overall strength and competitiveness of the organization. According to knowledge management theory, knowledge includes explicit knowledge and tacit knowledge. Explicit knowledge is the knowledge which is expressed with words, numbers and voice, such as theses, monographs, research reports, product manuals, data, visual graphs and audio tapes. Tacit knowledge refers to the invisible and impalpable knowledge, such as secrets, insight, intuition, apperception, faith, ideal, value, emotion and mental model. Explicit knowledge may be transferred to other people easily, while tacit knowledge can hardly be expressed. While paying attention to the management of explicit knowledge, knowledge management pays more attention to making tacit knowledge explicit so as to realize knowledge sharing and creation.

Difference and link between knowledge management and information management

Information management refers to an activity in which people comprehensively adopt technical, economic, policy, legal and cultural methods and means to control information flow for the purpose of raising information utilization efficiency and maximally realizing information utility value, whereas knowledge management not only includes the control and management of information flow but also realizes knowledge and information sharing and creation through establishment of a perfect sharing system and cultivation of sound organizational culture. The core of knowledge management is to share and create knowledge and make tacit knowledge explicit. Thus it can be seen, information management is only a part of knowledge management and can only realize management of static information resource and other explicit knowledge, while knowledge management gives more stress on realizing knowledge and information sharing, exchange and interaction, and the added value of static information resource through managing staff and inclusion of tacit knowledge which are usually neglected by people.

Role of Knowledge Management

Since the end of the 20th century, numerous enterprises have implemented knowledge management and achieved remarkable results. Some world famous enterprises, such as IBM, Siemens, Hewlett Packard, Xerox, McKinsey and 3M all have implemented knowledge management. Ikujiro Nonaka, a renowned scholar who studies knowledge management, thinks after in-depth research that the key to the extraordinary performance achieved by Canon, Honda, Panasonic, Toyota, Olympus and many other Japanese enterprises in stiff competition is their implementation of knowledge management.

The practice of these enterprises indicates that the implementation of knowledge management may produce the following effects:

1. Promote information and knowledge exchange inside the organizations, avoid repeated labor and raise work efficiency.
2. Realize deposition and accumulation of organizational knowledge, upgrade personal knowledge to organizational knowledge and avoid knowledge gap and organizational amnesia due to brain drain.
3. Advocate knowledge sharing and creation, encourage mutual help and cooperation among staff and departments, enlarge the degree and scope of knowledge utilization and inspire employee’s creativity and initiative.
4. Make tacit knowledge explicit, enrich the capital of organizational knowledge and enhance organizational core competence.

At present, more and more enterprises have implemented knowledge management and some public institutions also have implemented knowledge management. In view of the results of the practice of these enterprises and public institutions, it is also necessary for Chinese science centers to implement knowledge management in order to improve science and technology communication effect. This will be illustrated below.

Role of Knowledge Management in Improving Science and Technology Communication Effect of Science Centers

From the perspective of communication science, the main factors that affect science and technology communication effect include communication subjects, communication content, communication techniques, organizational publicity and audience quality. The improvement of any of these factors may lead to improvement of communication effect. Science centers communicate science and technology mainly through audience's visit to science centers, so their exhibit design level and ability in organizing training and educational activities have a direct bearing on science and technology communication effect. Besides, the management level, organizational publicity level and audience service level of science centers all have a bearing on science and technology communication effect. Through implementing knowledge management, science centers may not only raise the work capacity of exhibit designers and educational activity planners and organizers but also lift the management level and audience service level of science centers, thus improving the communication content and techniques of exhibits and educational activities, making organizational publicity work better and ultimately realizing the goal of improving science and technology communication effect. That is to say, the role of knowledge management in improving science and technology communication effect is indirect.

Concretely speaking, the implementation of knowledge management in science centers may produce the following effects:

Make employees pay attention to the importance of tacit knowledge and more attention to the communication of scientific spirits, thoughts and methods

From the perspective of knowledge management, scientific knowledge belongs to explicit knowledge, while scientific spirits, thoughts and methods belong to tacit knowledge. As described above, the communication of explicit knowledge is easy, but the communication of tacit knowledge is difficult. No doubt it is important for audience to accept scientific knowledge when they visit science centers, but it is more important for them to learn scientific spirits, thoughts and methods. Therefore, during design of exhibits and organization of educational activities, the science centers should always bear in mind how to improve audience in scientific spirits, thoughts and methods after they visit exhibits and attend educational activities.

Raise the work capacity of exhibit designers and educational activity planners and organizers

The level of exhibit designers directly decides the level of exhibits, while exhibits are the foundation of science centers, so it is vitally important to raise the work capacity of exhibit designers. Meanwhile, as informal educational institutions, science centers also assume an important task of education. The educational activities provided by them include exhibit / exhibition explanation, scientific shows, laboratory courses and popular science dramas. Effective educational activities can't do without careful plan and nice arrangement, so it is very important to raise the work capacity of the staff responsible for educational activities.

Exhibit designers and educational activity planners and organizers may improve their expertise through self-study, advanced studies, learning from experienced persons and attendance of seminars. In this process, they should study hard, comprehend tacit knowledge, convert it into their own knowledge and make it explicit if possible. Through implementing knowledge management, exhibit design department and educational activity management department may help their employees know explicit knowledge and tacit knowledge in a better way, make tacit knowledge explicit, fulfill knowledge sharing and creation, effectively improve employee's work capacity and teamwork spirit and finally design high-level exhibits and develop high-level educational activities. Making tacit knowledge explicit plays a significant role. The example below is enlightening.

In 1985, when Panasonic researched and developed a new type of household toaster, the bread was burnt outside and unbaked inside every time. The R&D personnel racked their brains for a solution in vain. In Osaka, Osaka International Hotel was known far and wide for its delicious bread. In desperation, the company assigned Ikuko Tanaka – a software R&D staff to learn "kneading" technique from a bread chef of the hotel. Gradually, Ikuko Tanaka found that the chef's kneading technique was unique. After one years' effort, Ikuko Tanaka closely cooperated with project engineers and finally proposed modification to the structure and performance of the machine, including addition of special rib-shaped convex grains on the inner wall of the machine, thus successfully reproducing the kneading technique he learnt in the hotel. This created Panasonic's unique "fried dough twist" technique. This product set a new sales record of new-type cooking utensils in one year since it was put into the market. The R&D of the toaster succeeded in the end because the R&D personnel dug out the tacit knowledge that even bread cooks couldn't explain clearly, and properly applied it. [1]

In actual work, perhaps the employees of science centers may solve problems only after numerous setbacks and innumerable hardships. When we share our knowledge and experience with others, it benefits both others and ourselves. In reality, we often think that we know a thing, but when we try to speak it out or express it with language, we find it is very difficult for us to speak it in a systematic and complete manner and make others understand it, mainly because our understanding on this knowledge point is not as proficient as we think. In this case, we should learn and study this knowledge point more deeply. After longer communications with others and more extensive reading and discussion, we may become proficient gradually. Therefore, we shouldn't rest content with the degree of thinking we know and should do some conscious work to make it explicit and should consciously make others understand the principles we know. If we form this habit, it will prompt us to more deeply probe into the roots of problems and raise the level of our understanding on knowledge. If we develop a habit of consciously making our knowledge explicit, we will find our understanding on problems is getting deeper, thus getting rid of the state of a smattering of knowledge and raising our ability. [2] On the other hand, as long as we carefully think over other people's experience and lessons, we may learn a lot from them.

Dig audience demands through management of audience knowledge

Many science centers collect and analyze audience information and know their comments and demands on the science centers by means of audience message, questionnaire and seminar in order to improve their work and meet audience's demands in a better way. Regretfully, some science centers don't carefully study the collected audience information and fail to discover some audience's potential demands. In this aspect, Wal-Mart's "story of beer and diaper" provides much food for thought.

During shopping basket analysis on customer' shopping behavior, Wal-Mart discovered unexpectedly that the commodity bought most together with diaper is beer. For this reason, Wal-Mart investigated and analyzed this result. A plenty of actual investigation and analysis revealed a consumption tendency of Americans behind "beer and diaper": American wives often ask their husbands to buy diapers for their babies after work, some young fathers will buy baby diapers in supermarket after work and 30%~40% of them will buy some beer for themselves in the same time. Since the chances of buy will increase when diapers and beer are put together, Wal-Mart places diapers and beer together in each of its outlets. Consequently, the sales volume of diapers and beer rose significantly.

After reading this example, we should ponder over: does our investigation indeed dig out audience's demands? Do we initiatively share the information we dig out with other departments? The answers may not be satisfying. This requires science centers to truly dig out audience's demands through implementing knowledge management so as to design exhibits, carry out educational activities and meet audience's demands in a better way.

The Key and Difficulty to Successful Implementation of Knowledge Management

According to the practice of numerous domestic and foreign enterprises and public institutions, the key and difficulty to successful implementation of knowledge management rest with human factor and active participation of all staff, not the establishment of a knowledge management system. To generate a good effect from the implementation of knowledge management, science centers should solve the following critical problems: [3]

Correctly and comprehensively understand the connotation of knowledge management

Without correct understanding on knowledge management, inevitably the outcome may be in the opposite direction during the implementation of knowledge management. Some people think knowledge management is information management, knowledge management can be bought through purchase of technology and software, and the establishment of a knowledge management system means the completion of knowledge management. This understanding is one-sided. Knowledge management is system engineering and not only contains all content of information management but also pays more attention to managing staff and relates to organizational culture, organizational structure and operating mechanism. Therefore, in no case can a set of knowledge management software solve fundamental problems. The core factor of knowledge management is human.

Leaders' long-term support

In the process of implementation of knowledge management, the greatest resistance perhaps comes from the managers or employees who don't like or are reluctant to adapt to new work environment. In the face of various resistances, firstly the leaders of the centers should overcome themselves in concept, change their concept and give support to the implementation of knowledge management from the aspects of human resource, material resource, capital and time. Then, they should participate in the implementation of knowledge management, convince employees with sufficient reasons and their personal experience that knowledge management indeed will bring benefit for the science centers.

Each science center should establish a knowledge management team and appoint a knowledge supervisor assumed by one leader of the center who is responsible for this work. Only when one leader of the center assumes the position of knowledge supervisor can the goal of knowledge management cooperate with the goal of the science center. According to the experience of other organizations, if the work on implementation of knowledge management is handed over to grass-roots technicians or there is no knowledge supervisor, the due effect that should be achieved from the implementation of knowledge management would become impossible. Knowledge management is long-term work and needs persistent support from the leaders of the center in order to achieve a satisfying effect. Besides, during implementation of knowledge management, middle-ranking cadres serve as a bridge linking center leaders and grass-roots staff, their own departments and other departments, and their knowledge sharing behavior is very important, too[4].

Active participation of all staff

Only with the support of the leaders of a science center and without active participation of grass-roots employees, can hardly the science center achieve a good effect from the implementation of knowledge management. What is the most critical and also the most difficult in the implementation of knowledge management is to share and create knowledge and make tacit knowledge explicit. As knowledge is exogenous and employees have a competitive relation, considering their own interest, employees are reluctant to transfer their knowledge or have some reservation during the transfer of knowledge. Therefore, science centers should formulate an evaluation method and an effective incentive mechanism for knowledge sharing, take various measures to form an organizational culture good for knowledge sharing, reasonably evaluate and reward employees based on the knowledge contributed by them in order to stimulate employees' enthusiasm and make them spare no effort to contribute their own knowledge (tacit knowledge in particular) in a good atmosphere of mutual trust and mutual respect, thus reducing the management cost of the science centers, raising the operating efficiency of the science centers and realizing the goal of improving science and technology communication effect of the science centers while raising the quality of each employee.

Conclusion

It is foreseeable that the implementation of knowledge management may further boost the strength and undertakings of science centers. Under the background that the research on knowledge management theory is going deeper and practical application is getting wider, Chinese science centers should implement knowledge management in the earliest possible time so as to elevate exhibit design level, educational activity level, management level, organizational publicity level and audience service level as soon as possible and communicate science and technology in a better way.

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A General Research about the Role of Science Center and Science Museum—From the Perspective of Dealing with the Global-Warming Problem

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Abstract. As we all know, climate-warming has become an indisputable fact, and this world-wide problem brings a series of serious results, such as climate change, the rising of sea-level and acceleration of glacier-melting, endless natural disasters and so on, which pose a serious survival challenge to all living things, including human beings. Climate-warming is a global problem, and it is the common challenge facing the people of the whole world. We have to attach a great importance to this problem. This paper argues that, to deal with global climate-warming, all the countries in the world need to act together. As for each individual, the most important point is to develop a low-carbon lifestyle, which was advocated during the Climate Change Conference in Copenhagen in 2009. Then, as the main place for people to get knowledge and attitudes about science and experience scientific research, what role should modern science center and science museum play in dealing with this crucial and urgent global climate-warming? This paper argues that, based on the above question, The modern science center and science museum should pay much more attention to help people understand and learn how to deal with climate-warming, not only just focus on the popularization of the knowledge of science and technology, scientific and technological achievements, and providing places for people to play interesting experimental games. Modern science centers and science museums should establish a special area to highlight climate-warming problem, where people have access to know the origin of climate-warming and what challenges it has posed to the whole world. These centers and museums help people realize the importance and the urgency for all countries to deal with climate-warming problem, as also show people the achievements which have been made in recent decades, it also introduces the main practices adopted by all countries in the world. The most important point is to help people get knowledge about how to deal with climate-warming in everyday life, introducing the subject of low-carbon to the people, advocating low-carbon lifestyle, help people develop low-carbon living habits in every detail of daily life and make contributions to lessen the problems due to climate-warming.

Science Center as Tool for Communicating Science in India–A Review

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Abstract. This study highlights the impact of science and technology centre via., museums, zoos, aquaria and science centre in India to promote science knowledge among the public. There is significant evidence that interactive science exhibitions increase visitors' knowledge and understanding of science. The Science & Technology centre have provided memorable learning experiences which can have a lasting impact on attitudes and behaviour of the visitor. Further, this centre has wide-ranging personal and social impacts and promotes inter-generational learning and promotes trust and understanding between the public and the scientific community. The economic impact of centre is also felt in this review. The difference between a science museum and a science centre is like a line drawn in water is also felt in this study. There is a very substantial body of evidence for learning occurring has been understood mostly from studies of families using interactive exhibits in centre. It is also highlighted in the review that Centre elicits powerful emotions, which help create memorable learning experiences as well as wide-ranging personal and social impacts. There is significant evidence observed in the study that Centre provide lasting benefits. Learning that occurs today depends on yesterday's learning and is the foundation for tomorrow's learning – concept is underlined in the centre objective.

Keywords: Science centre, Interactive learning, Impact

Gujarat Science City: Cultivating Scientific Creativity in the Community

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Abstract. The Gujarat Science City (GSC), working under the aegis of the Department of Science & Technology, Government of Gujarat, is emerging as an effective and large scale science education and popularization platform in the country to promote innovative and experimental activities through hands-on activities and minds-on exposures.

GSC adopts the approach and methodology of informal community based learning that is different from the formal mode of education. All of its programs and activities are intended to enliven the imagination, foster creativity and develop a spirit of inquiry, especially in young minds. Schoolchildren, during their visit, are discovering the wonders of science and technology and get an access to the most exciting and contemporary form of entertainment regardless of the social stratum, education or age group and create a culture of learning.

GSC extends the earlier models for science museums and science centers by integrating key characteristics from theme parks, retail, and theater to create a new form of educational attraction called edutainment, i.e., education through entertainment.

GSC plays an effective role as a vanguard for the dissemination of the latest science information for understanding our world, raising public awareness of current research and stimulating an interest in science among young students and community members. The content is focused on the programmes, activities, galleries, displays, exhibits, methods, means, strategies etc to attract and inculcate scientific temper among the students as well as visitors. The creative, enthusiastic and entrepreneurial approach in each of the programmes of GSC is effective and relevant, meeting the pedagogy of science teaching and learning. We shape minds and meaningfully connect our communities to the world around us, reaching students, teachers and families with the fascination and promise of careers in the sciences.

The trend is up beat and the Gujarat Science City is now acclaimed as a must see destination for at least 15,00,000 visitors annually, where science is a fun. The place is being recognized as a must see Science Tourism destination for respecting science and creating future scientists of the country.

The paper describes the innovative approach of GSC in designing the tools and techniques for public understanding of science along with cultivating scientific creativity in the community to capture new heights in science literacy in support of effective decision making.

What is Science Museum? –Case Studies on Chinese Science and Technology Museum

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Abstract. As an important science communication pattern, what is the role of science museum is a question worth considering. This paper, taking the development of Chinese Science and Technology Museum (CSTM) as case studies, researches the role of science museum from the science communication aspect.

Firstly, science museum is a science teller. It tells the public what is science and technology. From exhibits to experiences, the initial purpose of CSTM is to let public know the specific science knowledge. However, science communication is to explain the scientific meaning and the beauty of science, rather than to emphasize the important position of science. Therefore, the purpose of science communication is to help the public and the scientific community for science& technology-related matters between the make correct judgments and decisions. As a result, science museum should be as a tutor of science literary. This is the second role of science museum. It should be noted that science literary not only contains specific knowledge, but should be elevated to a level of critical spirit and scientific habits of thinking levels. Thirdly, science museum should be a science discussant. As science and technology is a double-edged sword, science museum should not only provide public the useful side of science, while abandoning the discussion of the hazards of science. How to provide such platform among public, scientists and scientific community, should be an important discussion point for science museums' further development. At last, science museum should be as a science leader. In the modern time, both developed and developing countries, promoted scientific human resources as a strategic resource to enhance core elements of national competitiveness, vigorously strengthen scientific and technological human resources capacity building. Endless train a large number of high-quality vibrant and innovative talents, directly related to the country's future. As an enduring vitality, fixed place of science communication, science museum has inherent advantages of scientific human resources training. In the further development, science museum should paid more attention to select scientific talents, stimulate young people's intrinsic interest in science, cultivate the courage and firm determination in the continued science practices.

IEC: A Study From the Science Communication Prespective

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Abstract. Information, Education and Communication (IEC) is dealing with bridging the digital divide, gender divide and knowledge divide using different communication tools at different levels. This paper specially focuses on Village Resource Centres (VRCs) and Village Knowledge Centres (VKCs). VRCs and VKCs mainly provide need-based locale-specific, demand driven information content (both dynamic and static) based on collection of several secondary data and a well-planned need assessment, organizing training and awareness programmes and making linkages with several leading institutions / organizations for translating the content into field-based applications.

The study also specially refers to “Mission 2007: Every Village a Knowledge Centre” by MSSRF. The purpose of the movement is to know how we will take ICT-enabled development activities to all over India particularly in the rural areas as a consortium mode. Since then every one of this network members will meet and discuss many issues related to content, capacity building, care and management, connectivity, financial sustainability, etc. The mission is referred to as ‘Grameen Gyan Abhiyan – Rural Knowledge Movement” since August 2007.

Under the CD-ROM library this programme provides necessary research inputs to researchers in the area of agriculture. The Hindu Media Resource Centre of the MSSRF is organizing several theme-based media interactions, organizing millennium lectures, etc. in different facets of sustainable development.

Augmenting and Sustaining Informal Science Education: A Project for Professional Development and Community Building for Informal Science Educators

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Abstract. When critical issues arise such as climate change and energy transitions, when natural disasters occur (e.g., hurricanes, earthquakes, floods, drought, etc.), or when local populations are asked to make important decisions regarding Earth science issues (e.g., drilling for oil or gas, clear-cutting forests, building dams, etc.) local populations needs credible scientific information on these subjects in a timely manner. Most people get their information about Earth science issues from informal sources (outside of formal—kindergarten through college—education). A decade ago that meant that most of the public got their information about science from *informal venues*: science centers, museums, zoos, parks, aquaria, etc. Today, however, informal sources of information also include Facebook, Google, Wikipedia, and other websites and media. Although there are some media and online resources that do disseminate credible science research, many do not reflect accurate scientific information, and the struggle to get credible information to the public has greatly increased.

There are thousands of informal science venues across the globe – many in rural areas serving groups underrepresented in the sciences. These venues can be excellent sources for dissemination of credible, timely science information to the public. The fact that an estimated 150 million people in the U.S. visit the more than 400 U.S member museums of the Association of Science-Technology Centers every year (www.astc.org) and that in total American museums average over 865 million visits per year (www.aam-us.org) reflect incredible opportunities within these venues to educate the public about Earth science. Most Americans have never taken a geoscience course; yet in the informal setting of a museum, learning can occur among audiences of all ages and backgrounds. Unlike formal education settings, the open-environment, collections, exhibits and resources that informal science venues provide allow for a more visitor-directed learning experience, allowing visitors to ask questions and discover at their own pace—an "inquiry-based" environment. This can lead to enriched lives, Earth stewardship, and public understanding of Earth science research. Many scientists can trace their first motivation to pursue a career in science from such informal experiences as visiting a museum.

To assess the current state of informal Earth science education, the Paleontological Research Institution (PRI) conducted a U.S. National Science Foundation (NSF) funded study to survey museums and science centers throughout the United States—a sampling of the informal Earth science community that offer at least some Earth science education and/or exhibits. The survey was mailed to over 300 institutions, and was filled out and returned by individuals from 75 organizations. We believe that the museums that responded to our survey are fairly representative of the whole sample, and any bias would likely, if anything, over estimate the amount of Earth science available in museums since organizations with little Earth science exhibits and programming would most likely not have replied to the survey. Most museums in our sample are less than 10,000 sq meters (median of 1,900 sq meters) with a median number of 44 full time staff equivalent. The median number of staff per organization involved with education and exhibits who have geoscience training **(**degreed in Earth or geo-science) is only one (1), and about 1/3 of institutions have no Earth science trained staff. The lack of qualified, Earth science educated staff in informal science institutions underscores the need for quality professional development for these educators.

To give staff working at these informal science venues an opportunity to enhance their Earth science knowledge and to develop inquiry-based programs, in 2007 PRI partnered with the Institute for Global Environmental Strategies and the Earth System Science Education Alliance (ESSEA) to develop and pilot a 10-week, one--credit graduate-level course for informal educators, called "Global Climate Change and Informal Earth System Science." In this course, the participants review the basics of Earth system science and how to gather and disseminate credible information on climate change in a module entitled “Global Climate Change.” Next, the students put this knowledge into practice by expanding upon existing collections, exhibits, and/or programming at their venue in a second module, “Earth System Science in Your Backyard”. The course culminates with participants creating a "Virtual Fieldwork Experience", in which they focus on a local site and create an inquiry-based exhibit or program from an Earth science perspective that is relevant to their local population. The course is asynchronous and entirely online; content and resources for the course are all online, and a website was developed by Dr. Buckler for forums and discussion groups. Students complete weekly assignments, working both in teams and as individuals. Graduate credit for the course is offered through State University of New York, Oneonta, (SUNY) and Dr. Buckler (Adj Asst. Professor, Earth Sciences Department at SUNY) is available online for participants, and gives regular feedback to facilitate participants’ learning.

The response for the course has been overwhelming; for three consecutive years, 60 – 100 registration requests were received for the 10-participant class. Since the course is online and asynchronous, both geographic and time zone restrictions are transcended, thereby permitting a truly global community. During the three year pilot of the course we have been fortunate to have several participants working in territories and countries outside the U.S., including: in 2007, from Modena University, Modena, Italy; in 2008 from the Caritas Natural Preserve in Puerto Rico; and in 2009, a Cornell University graduate student working in the Bandipur National Park, Bangalore, India. After taking the course, V. Padovani, form Modena University, came to the U.S. for a 3-month internship at PRI to study how public science exhibits and programming are produced in the U.S. Dr. Buckler was then asked to be a PhD advisor to V. Padovani, and PRI has also since collaborated with and loaned a number of specimens from its collections to Modena University for study and use in outreach exhibits to the public. The experience of international cooperation and sharing of resources between participants and their venues has persisted to the present.

To continue providing quality informal science professional development and further build a global informal science education community, PRI is now seeking funding from NSF and the National Oceanic and Atmospheric Administration (NOAA) to expand and refine the current course. Based on three years of experience and evaluation, the course offerings would include:

- a module on incorporating evaluation into public outreach programming and exhibits,
- bridging the gap between informal and formal educators by learning to establish collaborations between informal educators and their local schools and teachers, and
- establishing a database of program and exhibit resources created by participants that can be used by other informal–and formal–science educators from around the world.

Under the current project, for international non-credit students, tuition for the informal educator professional development course is waived; access to all resources is universal to all participants, and past participants are strongly encouraged to act as mentors for incoming students.

The primary goals of this course are:

- to offer quality professional development in Earth science so that participants can create their own, in-house, inquiry-based, relevant programming for their local audiences;
- to establish a core set of resources for informal educators to communicate science to the public; and
- to create global community among informal science educators, to enhance communication and share resources and ideas.

In this process, the value of an international exchange of resources and ideas among informal science venues from around the globe cannot be understated—especially given the need for global cooperation in addressing issues such as climate change, disaster preparedness, and natural resource preservation. Although many of the science issues and concerns facing populations around the world are unique, there are commonalities among effective methods by which informal science venues communicate reliable scientific information to the public.

In addition to offering this course, for the past decade PRI and its Museum of the Earth have also demonstrated its success in working with researchers at Cornell University and across the U.S. and in Europe to create exhibits and programming outreach for the public. Exhibits have included, “Marine Life versus the Gulf Oil Spill: Under Siege”, “Darwin: Modena and 200 years of Evolution”, “The Global Climate Change Project”, “The Green River Formation”, and “Exploring the Evolution of Biodiversity”. Currently, PRI is actively seeking to expand upon its current associations with informal science educators in Italy, Germany and Japan to include collaborators from across the globe.

Climate Change Induced Coastal Disasters and Mass Media

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Abstract. Time immemorial the humanity is faced with natural disasters. For many centuries people believed that the disasters are destiny or ordained which cannot be erased. Hence they faced the disaster and waited for the next to come. Now the scientific inventions have made us understand that the unending disasters are the causes of irresponsible behavior of mankind.

Disaster is one of the greatest challenges being faced by the mankind and thus Disaster management has become a prominent area of science communication. It is gaining in importance in the public sphere with NGOs, scientists, journalists, and policy makers in particular taking a pro-active stand. Sea level rise, cyclones, and floods devastate coastal low-laying areas. Such events triggered and/or aggravated by climate change affect millions of people in the developing countries the most.

India has been identified as one among 27 countries which are most vulnerable to the impacts of global warming related accelerated sea level rise (UNEP, 1989). The high degree of vulnerability of Indian coasts can be mainly attributed to extensive low-lying coastal area, high population density, frequent occurrence of cyclones and storms, high rate of coastal environmental degradation on account of pollution and non-sustainable development. Most of the people who are below poverty line are living in the low lying areas and are directly dependent on natural resources of coastal ecosystems who are highly vulnerable to any global warming-induced climatic change.

The role of media, both print and electronic, in informing the people and the authorities during emergencies thus, becomes critical, especially the ways in which the media can play a vital role in public awareness and preparedness through educating the public about disasters; warning of hazards; gathering and transmitting information about affected areas; alerting government officials, helping relief organizations and the public towards specific needs; and even in facilitating discussions about disaster preparedness and response.

There is a need to find out the effectiveness of the media in creating awareness, handling the disaster mitigations, its effects on the coastal areas and its short falls in meeting the social obligation; it is expected to perform to overcome the challenges it poses to the humankind. Whether the media has devoted its attention to coastal disasters? The study examines. Creating awareness during ordinary days is most important than the coverage during disasters to reduce the risk of a disaster, as disasters cannot be prevented. Keeping in view of the broad objective on the role of media in disaster management in public safety and emergency, whether the level of awareness created by the media is sufficient?

The methodology is based on content analysis of the media text to show the process of coverage of coastal disaster in terms of creating awareness, by analyzing the media content in the past one year in the popular English magazines like *India Today*, *Outlook*, *The Week* and Front line.

In this research it was found that articles were covered by the magazines as an event and not as a process that examines the causes in-depth. The contents on disaster awareness were very meager, less proactive contents were found, most of the media focuses attention on the death toll, not caring about the relief measures. The media has not proposed an alternative plan for the rescue operation. The media should act as a positive force. Positive news coverage can reduce terror and give some psychological relief to the affected community.

Adaptations for Climate Change and Coastal Disasters Using Information and Communication Technology

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Abstract. Information and Communication Technology application of village Information Centres are computer-based information network set up in villages to supply locally-needed information and to empower the villagers. They are called by different names: tele-centres; village information centres; village resource centres and their subunits village knowledge centres; and information kiosks. They are particularly effective in 1000-odd km coastline of Tamil Nadu and Pondicherry prone to disasters and are widely acclaimed as successful ICT ventures.

Such village knowledge centres and village resource centres (VKC) initiatives of the MS Swaminathan Research Foundation (MSSRF), Chennai, Pondicherry Multipurpose Social Service Society, Pondicherry, DHAN foundation Madurai, Sathiyabhama university in kaniyakumari and Nagargoil coastal districts are an effort to present workable models of providing information and communication technology (ICT) for development. Villagers in a fishing village are keen to get accurate forecasts of wave heights and location of fish shoals. The women need more information on health-related issues from women doctors. That is why it is important to provide timely locale-specific information. The information provided should be authentic and useful in the specific context. Staff of village knowledge centres work closely with partner organizations such as government hospitals, health organizations, judicial courts, agricultural universities, research laboratories and field stations and marketing organizations.

ICTs are tried out to bridge gender, social, economic and technological divides. The resource centre is at the core of the ICT for rural development movement. Particularly under the circumstances of climate change when temperature rises, crops fail and fish yield decreases, people indulging in these as primary occupations are left with less money, and any sort of support including that promoting good health is really a great relief.

The paper would examine the challenges and opportunities, potentials and pitfalls of using ICTs for tackling climate change, particularly in coastal areas which are more sensitive towards climate change. The study would specifically focus on village resource centres and explore their role and relevance for creating climate change awareness. The prime objective of the study is to study the effectiveness of Information and Communication Technologies particularly village resource centres (VRCs) in creating climate change awareness particularly in coastal areas.

Some village knowledge centres and village resource centres along coastal areas have been studied. The reason for targeting socio-economic backward coastal communities is that they have not taken environmental and climate change lessons and honing the skills of the people in this coastal area will have great social impact. Although educational level may be low, environment awareness is increasing in the coastal areas as coastal environment is fragile and prone to several hazards such as cyclones and the resultant storm surges, and the coastal communities have an urge to protect ecology.

Communicating About Space: The Final Frontier?

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Abstract. Late 2006 Belgium joined an educational pilot project of the European Space Agency. The purpose of the project was to set up a space education resource center in the countries participating in the pilot program. An explorative research towards the needs of the Belgian education landscape concerning space and astronomy, gave ESERO Belgium the knowledge needed to start up the project. Space is regarded as something fascinating, therefore it is an excellent subject to make children familiar with science and technology. A lot of teachers feel the same way but the research showed that teachers (or other educators) are often scared of communicating about space. They feel insecure about their knowledge of the subject and thus try to avoid communicating about this subject or do so in a not very exciting nor interactive way. This is where ESERO steps in. Not only does ESERO provide high quality educational material (about space and astronomy) for teachers, youth organizations, etc to use, the project manager also organizes workshops for them to explain how to make optimal use of the material and to help them in their communication about the subject.

Almost three years later ESERO Belgium has booked some big and small successes. We have organized major events about space (with astronauts present at the events), to introduce the theme “space” and also astronomy to kids and youngsters of various age groups. We have developed teaching material, and are still developing more teaching aids. We are providing workshops regarding communicating about space for teachers, educators and most importantly student-teachers. The student-teachers are a very important target group, they are the new generation of educators who need to stimulate and get our children enthusiastic about science and technology. ESERO Belgium would like to introduce the project in a parallel session at the PCST conference. ESERO is regarded a best practice case for communicating about space. We have build up some extensive experience concerning the do’s and don’ts in teaching the teachers communicate about space and space-related subjects. ESERO Belgium is located at the Planetarium in Brussels.

Role of Museums in Science Communication with Special Reference to Nehru Science Centre, Mumbai

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Abstract. Science is an unbiased body of knowledge that urges people to be questioning, reflective and critical. It is also a social endeavour pursued by scientists who are part of the existing socio cultural milieu. The question then arises whether the society is equipped to cope up with the rapid advances in science. Science has the potential to be either beneficial or harmful. Despite professing an apparently positive outlook towards science, there is in general very little awareness or understanding among the public of how advances in science and technology affect our daily lives. Many a times it also the public which bears the brunt of the bizarre consequences of science misapplied. So the public has to be infused with scientific knowledge as well as be empowered with the capacity to weigh the pros and cons and make prudent judgment. This conviction forms the rationale for communicating science.

Scientific knowledge is complex and so communicating science is not easy. In a modern democratic society, each citizen should be able to discuss knowledgeably the scientific issues affecting their lives and make correct decisions regarding them. This brings into fore the importance of science communication and the agencies capable of doing this. Science communication is the process of conveying simplified scientific information to the public using various means and media, and unarguably science museums/centres are the fore runners in this job.

A visit to any museum/science centre full of colourful and visually attractive gallery exhibits is always entertaining and overawing. But it also raises several questions. What is the mission of the museum//science centre? Is entertainment it's only purpose or is it something more? Does it just display artifacts or go beyond exhibits to communicate science?

As public institutions in the socio-cultural milieu, museums/science centres any where in the world profess to perform the three roles of Entertainment, Education and Evolving through the variety of programmes that they offer to the public. And one such museum in Mumbai metropolis is Nehru Science Centre, touted as the one of the largest science centre for the youngest citizens and attracting lakhs of visitors annually. With this in view the researcher has attempted to study the role of museums in Science Communication with special reference to the programmes conducted by Nehru Science Centre, Mumbai, for the period 1986-2006.

Using the case study method with some amount of quantification of data for the purpose of analysis, the researcher has profiled the growth of Nehru Science Centre during the period 1986-2006 and has described the various activities of the centre in terms of its roles and related them to the identified dimensions of science communication through the model of science communication developed by the researcher. The model views the museum as an informal learning setting, influenced by the relevant theories of learning and communication, and performing the three roles of Entertainment, Education and Evolving through the variety of programmes and also communicating science.

The process of science communication has been envisaged as having four dimensions which are assumed to be static and hierarchical.

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Museum roles

Entertainment **Education** **Evolving**

Museum/ Science centre programmes and activities

Science Communication Process

Dimension 1	Dimension 2	Dimension 3	Dimension 4
Knowledge	Comprehension	Participation	Deliberation

Dissemination

In order to facilitate analysis the researcher has also developed an arbitrary Science Communication Index.

The study concludes that Nehru Science Centre has grown over the two decades both in quantity and quality of the programmes and activities. All the programmes are aimed at entertaining and educating the public, underpinning the center's commitment to these roles. The Centre is found wanting in the areas of research and staff development. Also in the process of science communication there is an evidential shift from mere dissemination of knowledge to more of participation. So if better emphasis is given for research and staff development, if programmes involving the public like citizen panels, public debates on health related issues are held, perhaps the days are not far off when Nehru Science Centre will reach the deliberation mode, which is the ultimate goal of science communication.

Dual Identifications of Science Centre: Research and Practice in China

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Abstract. Science centres in China nowadays are generally facing great pressure in sustainable development. Most reasons of this dilemma are the differences between the special dual identifications of the science centre: the role of the public welfare purposes in the science centre identified by the government, the need of the market player role identified by the science centre itself. The possible solution is to give the science centre a normal identification, the marketing player identification generally owned by the international science centres.

Keywords: Science centre, Identification, China

In China, a government-led catch-up modernization country, the cause of science centre starts from zero and grows rapidly to be a vigorously new member in the international community of science centre s in 22 years[1]. Its development experience is worthy studying by other countries, especially by the developing countries.

Since its establishment in 1988, the cause of the science centre in China has made remarkable development. All kinds of science centres reach 200 and attract 40 million visitors each year, making a great contribution to the dissemination and popularization of science and technology. However, most science centres in China nowadays are facing great pressure in sustainable development and survival. Most reasons of this dilemma are the differences between the special dual identifications of science centre: the role of the public welfare purposes in the science centre identified by the government, the need of a market player role identified by the science centre itself.

The Identification of the Government on Science Centres

The identification of Chinese government on science centres is closely connected with its understanding in the importance of science and technology, the dissemination and popularization of science, and most of all the role of science centre.

The future of science and technology is determined by the value endowed by the society [2] . In the past half century, Chinese government more and more realized the important role of science and technology. In 1950s, Mao Zedong thought the more the people, the stronger the force, which emphasized the importance of man rather than the power of science and technology. This point lasted more than double decades. By 1978 the Reform and Opening began and the spring for science came in China. On September 5th, 1988 Deng Xiaoping clearly pointed out that science and technology are the primary productive force. At the beginning of the 21 century, Hu Jintao further advanced the strategy theory of building an innovation-oriented country, putting the innovation of science and technology as a national fundamental strategy, greatly improving the capacity of innovation in science and technology and then forming the national competitive advantage. The implement of this strategy calls for increasing the level of research and development in science and technology all over the country and improving the level of scientific literacy for all Chinese citizens.

At the same time, the government in China more and more realizes the importance of the dissemination and popularization for science and technology. In August 1950 Chinese Association for Science and Technology Popularization, the predecessor of Chinese Association for Science and Technology (CAST), was found and preluded the great cause of dissemination and popularization for science and technology in new China. However, a situation that stresses scientific research and looks down on its popularization lasted decades. In addition, scientific workers were unwilling to do this job either. Gladly, this situation greatly changed in recent years. In June 2004 Hu Jintao declared

[1] Cheng Donghong: *Opening Speech for Chinese and Foreign Science and Technology Museums Forum*, 2009.

[2] Christopher Bryant and Michael Gore, *the Development of the Public Communication of Science Center: Study on the Australian Public University*. Science centers for this century, Sainte-Foy, Quebec : Éditions MultiMondes, 2000.

that the innovation of science & technology and its dissemination and popularization are the double aspects of scientific cause. For the first time, the innovation of science and its popularization are stressed equally at national level.

As Chinese government more and more realizing the significance of science and technology, it began to concern and support science centres which is considered as an important channel for scientific dissemination and popularization. In 1958 Chinese government had intended to build the Central Science and Technology Museum, the predecessor of China Science and Technology Museum (CSTM), which stopped eventually for the shortage of capital and materials. Obviously science centre was not a necessary but dispensable infrastructure for scientific communication at that time. After the Reform and Opening, everything changed. In the National Science Congress in 1978, which marked the beginning of scientific spring in China, many famous scientists such as Mao Yisheng and Qian Xueshen suggested once again to build CSTM and started the long march of its construction. By September 22, 1988, CSTM was founded and opened to society, beginning the cause of science centres in China either. At the same month, Deng Xiaoping advanced the famous point that science and technology are the primary productive power, which is not just a coincidence by chance As the history went into 21 century, science centres are booming in China. In 2008，Chinese government declared in the Science Facilities Development Planning（2008-2010-2015）that it will optimize the layout of national science centres with at least one science centre in large and medium-sized cities. According to the requirements of “Scientific Outlook on Development”, the central government and provincial governments are committed to the development of the science centre which is concerned playing an indispensable role in spiritual civilization construction and economic and social progress. Science centres nowadays become an important civilization symbol for a city. Up to now there are more than 200 science museums in China, including 30 science centres of modern characteristic, though most of them are called science and technology museums. Each year more than 40 million visitors go into the science and technology museums or the science centres. (Refer Table 1)

Table 1.Views and affairs on science & technology in different decades in China

Decades	Views on Science	Science Communication	Science Center Affairs
1950s	The more the people, the stronger the power.	In 1950 Chinese Association for Science & Technology Popularization was found.	In 1958 the construction of Central Science & Technology Museum stopped.
1980s	Science & technology are the primary productive power	In 1978 many famous scientists suggested once again to build CSTM in the National Science Congress which started the spring of science in China.	In 1988 CSTM was found and the cause of science centre in China started.
2000s	Implement Scientific Outlook on Development and build an innovation country.	In 2004 Hu Jintao declared that the innovation of science & technology and its dissemination and popularization are the double aspects of scientific cause.	In 2008 *the Science Facilities Development Planning*（2008-2010-2015）declared to build at least one science center in large and medium-sized cities all over China; SSTM, GSC and the New Museum of CSTM are found and list in the top 10 science centres in the world for their sizes and scopes.

In the new century Shanghai Science and Technology Museum (SSTM), Guangdong Science Centre (GSC) and the New Museum of CSTM are founded one after anther, everyone of which has been invested about 300 million $ and lists on the top of 10 science centres in the world for its size and scope. SSTM and the New Museum of CSTM both attract 3 million visitors a year. Today science centres in China are playing a significant role in the dissemination and popularization of science and the improving the level of scientific literacy for all Chinese citizens.

However one fact must be pointed out that as to the remarkable development of science centres in China in the past two decades, one reason was that Chinese government and society more and more realize the significant role of science centres in the dissemination and popularization of science and technology, anther important reason cannot be ignored was the booming economy in China at the same time.

Reviewing the long march that science centres in China has gone in the past two decades, there are at least two characteristics which are obviously different from other countries.

First, Science centres in China play a significant role in the dissemination and popularization of science and improving the level of scientific literacy for all Chinese citizens.

Second, the science centre is the public welfare. As to the identification of the science centre, Chinese government defines it with the characteristic of public welfare purpose, a public infrastructure for scientific popularization and an important platform to service the public for science communication.

Third, the government is vital in the construction and development of science centre. The government leads and cooperates with the science & technology circles and the whole society, forming a development path with Chinese characteristics of government-led, point to area, echelon development and then comprehensively promotion. The government concentrates its effort to build a few science centres such as CSTM and then, with this model, puts it forward to the provinces, cities and counties all over China.

The identification and construction model with Chinese characteristic are valuable which was proved by the remarkable development of Chinese science centres in the past two decades. However, this identification and model also demonstrate the shortages which follow up:

Firstly, science centres generally lack vigour and lose the ability of sustainable development. As the public agencies, science centres deeply bureaucrat and play poorly in the market, facing great pressure of development and even survival.

Secondly, there is no mechanism for companies endowing science centre. Without the powerful support of companies and communities, the government lonely sustains science centres, many of them become the heavy financial burden of all level governments.

Thirdly, the geographical layout of science centres in China is unreasonable. Most of them are clustering in the eastern coast areas and large cities, few of them in the middle and western areas and little cities.

Finally, science centres all over China are generally built from a few models and are highly similar to each other. Most of them are copied in some way from several science centres such as CSTM. If one had visited CSTM, he needn't visit other science centres any more. These standardized science centres lack their own characteristic and are short of attraction to visitors.

The Identification of the Science Centre on Itself

As to the development of the science centre, the first and most important key is a precise identification about itself: Who am I? What do I want to do? What can I do? How can I do it? Since its establishment in China, science centre circles spare no efforts to explore the identification on itself: What is the ideal science centre? How to construct it? How to develop it? Gladly, many conclusions have reached in some areas:

- Exhibition is the foundation of science centre and education is its soul. Exhibitions in the gallery should be organized by story-line or subject like a poem. Unfortunately, there is no education but exhibitions in some science centre for the chaotic arrangement of exhibitions.
- Exhibition should be secured, manageable, scientific , interesting and innovative. The security vetoes other aspects. No security, no exhibition.
- The key to the education of science centre is to experience the science & technology and inspire the innovation. It is less important to disseminate some particular scientific knowledge.
- As to books, magazines, newspapers, televisions broadcasts, internets and other

media, the advantage of the science centre in science communication is to experience the scientific scene.

- Child gallery is the most attractive part in the science centre. For example, the Science Paradise for children in CSTM attracts about forty percent visitors with less than one fifth exhibition areas of the whole museum.
- Preschool children (hoped a bright future by their parents), primary and middle school students (unifiedly organized by schools) and the retired elders (organized free activities) are the three majority visiting people[3], whose number is about 40 percent, 40 percent and 10 percent respectively. The numbers are slightly different in different science centres.
- Temporary exhibition, which needs little money and can easily arrange, is vital to attract visitors and enlarge the influence of science centres.
- It is significant to learn from international experiences. The newly built SSTM, GSC and the New Museum of CSTM all founded its international experts committee and absorbed international experiences worldwide, which have grown beautiful flowers.

It is no difficulty to find that the understanding and experiences on the identification of science centre in China are alike those acquired for many years in international science centre circles and there isn't some innovations any more. Furthermore, these experiences concentrate in the construction rather than the management of science centres. It shows that China has accumulated rich knowledge in the constructions of building and content in science centres and is capable to build international level ones. There is an interesting example. In the course of building some super science centre in China, the child science park had once contracted award to a famous international company. However, the foreign partner withdrew for some reasons and Chinese had to build it alone by studying home and abroad experiences. Nowadays there are more than one million children and parents in one year visiting this science paradise with just 3,800 square meters and the summit of visiting number a day is more than 10,000. All of these not only prove the former point that child gallery is the most attractive part in science centre, but also prove that it is more easily to absorb construction knowledge than to assimilate management experiences abroad.

As to management aspects of science centres between China and other countries, one can also easily find that there is an obvious, even fundamental, difference. Today China is capable to build an international level science centre but cannot find a good way to make it operate smoothly. It is a common situation in China that it is easy to build but difficult to cultivate a science centre. Most of science centres repeat a vicious circle that it is hot one year, cold three years and silent ten years. Audience numbers standstill and even reduce by years. Survival and development generally become onerous problem to them.

There are only two science centres outside this way: CSTM and SSTM. CSTM is located in Beijing, the capital of China. Since its opening in September 1988, it has served more than 20 million visitors at all. The audience number each year achieves 3 million nowadays from 100,000 in its beginning. On October 3, 2010 there are unprecedented 38,000 people visiting it. However, as to the reason of all achievements, a key factor was the seemingly inexhaustible and increasing subsidization from the government in the past decades, which enabled CSTM to greatly enlarge its building and exhibitions every few years and made it abandon all exhibitions to build a whole new museum in a new place in September 2009. It is rare to see such enormous investment from the government in the 200 years' development history of the global science & technology museums or science centres. SSTM is opened to the public in December 2001 and covers the Yangzi River delta which is the richest area in China. With the powerful finance from Shanghai municipal government, SSTM is the national tourist spot of AAAAA standard important science education and leisure travelling base. Up to now, it has attracted more than 18 million visitors by greatly promoting its science education and science travelling functions and widely winning social confirmation and compliments. Its audience number also increases yearly and reaches to more than 3 million a year. Obviously it has gone into a track of healthy development. As to sizes and scopes, Guangdong Science Centre is the largest science centre in China as well as in the world. However, there are just 800,000 people visiting its huge galleries each year. It is still uncertain

[3] Zhang Chengguang, *Probe the New Way of the development for Chinese Science and Technology Museum Industry*, 2009.

whether GSC has explored out its sustainable development way.

Unfortunately, the remaining science centres in China are less vigorous and perform poorly in the market few of them have a bright way ahead.

First, the poor finance from the government. For instance, a city science centre in a middle province of China receives only 50,000 $ from the government. It is less to the county science centre that it is 9,000 $ a year[4]. These capitals are obviously far from enough for an energetic science centre that wants to speak loudly in the society. Tianjin Science & Technology Museum is located in Tianjin, one of the four municipalities directly under the central government, and once the largest one in China in mid-1990s with about 400,000 visitors a year. It also faces the financial dilemma nowadays which the lowest fee is 1.6 million $ a year to operate it. However, the local government can just satisfy 40% of its need each year. Furthermore, the tendency free to adolescent in museums more outstands the shortage of capital in the science centre[5].

Second, the science centre performs poorly in the market. The ticket fee is the main source of income for most science centres. However, as to the shortage of capital, the exhibitions are obsolete and slow to replace; the facilities are old and security risks increase. Therefore, it is unable to undertake major activities and then greatly influences the exertion of its function[6]. As a result, the visitor reduces. So does the ticket fee and income. No wonder, the management comes into a vicious circle in many science centres all over China.

In one word, today the shortage of capital becomes the No. 1 problem for science centres in China. Even though many of them make double efforts to explore solutions such as launching science travel, arranging temporary exhibitions and learning from entertainment industry, etc. On the whole there has still not discovered the fitful new ways of development for Chinese science centres at this stage[7].

Dilemma and Solutions

In view of the whole 200 years' development history and management status of the global science centre, it is not hard to find that science centres in China are facing a structural and institutional dilemma toady, which deeply root in the great differences between the special dual identifications of science centre: the role of the public welfare purposes identified by the government, the need of a market player role identified by the science centre itself.

On one side, the government identifies the science centre as the public welfare agency and gives it financial support. However, except a few museums, all level governments are unable to provide enough financial subsidization. Moreover, the government classifies the science centre as museum then manages and subsidizes it like a museum. However, as everyone knows that the expenditure of science centres is greatly higher than that of museums.

On the other side, as the constitutional design of the public welfare agency, the science centre is deeply dyed with the colour of bureaucracy. With indefinite right and responsibility and without an inspiring mechanism, science centres have limited management capability like most public agencies.

In addition, there is short of the corresponding mechanism for enterprises to donate science centres. For example, the enterprise that endow science centre can reduce or avoid its tax. As a result the science centre almost receives no donation from enterprises and communities, which aggravates the management difficulty of science centres.

It is known to all that the expenditure of science centre in one year is one tenth of its construction fee for its expensive spending on operating and repairing exhibitions. As to the international successful science centres such as Ontario Science Centre and Los Angeles Exploratorium, their expenditure sources generally come from the financial subsidization of government, the income of science centre itself and the donation from enterprises and communities, which are about one third respectively. However, the hard situation of expenditure sources for most science centres in China is that the limited financial subsidization of government, the poor income of science centre itself plus the scarcely donation from enterprises and society. It is no wonder that they generally confront with tremendous pressure of development and even survival.

[4] Jin Kejun, *the Major Problems and Corresponding Solutions for Mid and Little Science Museums Nowadays*, 2009.

[5] LSM, *A Few Thoughts on the Sustainable Development of Science and Technology Museums*, http://www.donglikewei.com/news.asp?newsid=1917.

[6] Ipid.

[7] Zhang Chengguang, *Probe the New Way of the development for Chinese Science and Technology Museum Industry*, 2009.

Therefore, in order to resolve the structural and institutional dilemma twisting science centres in China at this stage, it should ponder and take actions from the structural and institutional perspective rather to adopt some tiny and trivial remedy arrangements. The following maybe some possible resolutions:

- All level governments should persist with the public welfare identification for science centres, applying the management system that is different from normal museums and increasing the financial subsidization for science centres.
- Give a normal identification to science centres which generally owned by the international science centres: possessing the management subject, with a clear definition of rights and responsibilities, reducing the colour of bureaucracy, bearing the internal and external motivate mechanism, and then fundamentally improving the capacity of management in the market areas because one cannot expect a government officer to be successful in the market. He must become a business person at first.
- Build wide channels for enterprises and communities to donate the science centre and expand the sources of income.

Scientific Heritage and Cultural Identity: A Mission Supported by ICTs and School

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Abstract. The paper shows the task to contribute to the construction of the identity, across the scientific heritage, the support of the ICTs and the school. All of three elements are important at the moment of strengthening the self-knowledge and the cultural auto-esteem. We discuss the results of an investigation realized in 2007 in urban and rural schools of Catalonia. The students had the opportunity to prove a virtual itinerary in a zone of the north of Catalonia (industrial heritage) rehabilitated as tourist place.

The project, the Knowledge and Heritage Value of Gerri de la Sal, was planned for working with the school-age public. It involved the design of a series of educational activities and teaching dossiers adapted to the different educational levels interested in exploring the on-line products. On- line and off-line experiences tell us of a public wanting to know about and use those tools available to help them to know their heritage.

The tool itself provides contents adapted for the following subjects: science, biology, technology, and social studies in sixth grade of Elementary School, third grade of ESO (compulsory secondary education), and first course of High School. This complement to the school curriculum represents a research proposal, which seeks to bring heritage itself closer to the school as an alternative to the problems of time, money and displacement.

The project was coordinated by the National Museum of Science and Technology of Catalonia (mNACTEC) and the study of the schools carried out by MUSEIA, Research Group of the Open University of Catalonia (Spain). We observed how the students of the rural zone, near Gerri de la Sal, knew its existence, its importance for the economy and their region, whereas the pupils of Barcelona showed a major ignorance in that matter. The above mentioned results rest on a theoretical part that is approached from the perspective of the public communication of the science and the presence of the ICTs in the heritage and the school.

Science Theatre–Obesity and Diabetes

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Abstract. The performance" Obesity and diabetes–is it just a matter of lifestyle?" Has been part of a communication arrangement for social and health workers in eight Danish municipalities, supported by the Danish national foundation for prevention of life style diseases. The project is a collaboration between the Science Theatre and internationally recognized scientists at the University of Copenhagen The incidence of obesity and diabetes is increasing all over the world and is a serious threat to public health and healthcare. It is a general opinion that it is caused by lack of self control and bad habits. However recent research has revealed a strong influence of genetic background, the nutritional condition during pregnancy, early childhood nutrition, the bacterial gut flora and physical activity. As many obese people are stigmatized by guilt and social isolation it is pertinent that they are informed about the scientific facts that may help them to accept and improve their situation. Scientists participate alongside professional actors, dancers and musicians. Science theatre is a performing art where the audience can learn with their senses and feelings as well as their intellect. Science theatre makes complex research understandable to a broad target audience. Complex scientific issues are explained on stage by the scientists. The understanding is facilitated by the dramatic, visual and humoristic tools of traditional theater to help the audience gain new insights. scientists participate alongside professional actors, dancers and musicians. Science theatre is a performing art where the audience can learn with their senses and feelings as well as their intellect. Science theatre makes complex research understandable to a broad target audience. Complex scientific issues are explained on stage by the scientists. The understanding is facilitated by the dramatic, visual and humoristic tools of traditional theater to help the audience gain new insights.

Keywords: Art and science, Science theatre, Interactive communication, Ethical matters, Obesity, Diabetes, Health science

Science-Philately–A Tool for Science Communication without Frontiers: India's Contribution

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Abstract. Stamps collection is very much fascinating to every one, irrespective to age and nation. Many people used as hobby including some kings, president, and elites. These attractive pieces of papers is a tool for providing important messages, anniversaries, celebrations, and propagandas and sometimes cultural and heritage of the country. It also provides the detail of overall development of a nation. It is always used as a propaganda medium with which to transfer messages to a broad audience.

Science philately means collection and study of commemorative postage stamps on scientific theme, which provide a useful medium for the study of Science history. As well as, it acts as a useful tool in a Science communication and dissemination of scientific development and Health related issues to broad audience. Science Communication through science philately in the real term science Communication without frontiers.

At the pre -independence era, in India there was handful scientific events, developmental issues and personage appeared on postage stamps. More recently the topic science has become a collectible commodity along with animals, flowers, space exploration, health and socio-cultural themes. There are a variety of Indian stamps which have been issued with a scientific theme.

Today India is also forefront in releasing the Stamps and it too depicted Scientific and health event, eminent scientists including Nobel Prize winners, scientific Institutions. These stamps are the main tools for disseminating scientific thoughts and messages and inculcating science and health related issues among masses.

This paper briefly reviews the contribution of Indian science-philately especially stamps on science personage, institutions, discoveries and special science days cover through Indian commemorative postage stamps.

Saranjamshala–CSIR Rural Technologies Gallery

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Abstract. The Council of Scientific and Industrial Research (CSIR), India`s premier S&T organization has a mandate to innovate and shape sustainable rural technologies to help the common people and smaller communities for better quality of life by realizing the use of the technology. It has 37 working laboratories around the country and in the pursuit of strengthening the nation from grass-root level, it has undertaken several R&D programmes and developed over 365 promising technologies for the rural communities in the areas of agriculture (farm & non-farm), drinking water, leather, building materials, natural fibers, ceramics, medicinal and aromatic plants etc. These technologies have shown large impact on the socio-economic conditions of the rural people and CSIR is currently operating a project which aims at bringing solutions to 800 million people in the country under a innovate program called CSIR 800.

CSIR is now continuously striving towards the outreach of these technologies to the rural areas for attracting prospective entrepreneurs. In this process, it has established a Rural Gallery named "*Saranjamshala*" at Bhopal to showcase its prominent rural technologies for their effective outreach. Models, exhibits, products and other information related to CSIR rural technologies have been displayed in 5 theme showcases and 14 individual laboratory showcases. The gallery is a permanent showcase of CSIR rural technologies to depict the success stories of rural development and is continuously visited by of NGO`s, KVK`s, Rural Artisans, Entrepreneurs' etc. The paper discusses various aspects of CSIR rural technology dissemination and how effectively these technologies have been showcased.

Keywords: Rural technology, CSIR, Dissemination, Rural gallery

Introduction

Technological interventions are vital elements in the socio-economic development of any region. A majority of the world`s population, especially in the developing countries live in rural areas and it is utmost important to develop sustainable and meaningful technologies for improving their quality of life. This would call for significant technological interventions in many areas which include water, shelter, energy, environment, health, food, farm and nonfarm sectors. The Council of Scientific and Industrial Research (CSIR), India`s premier S&T organization and one of the world's largest publicly funded R&D agency has a mandate to innovate and shape sustainable rural technologies to help the common people and smaller communities for better quality of life by realizing the use of the technology (CSIR, 1995).

During the years 1997-2002, CSIR has prepared a plan for its orientation towards rural development programs and brought out a focused program called "Rural Action Program" (RAP). The program is largely concentrated on the effective dissemination modes of prominent rural technologies by the way of publication of journal of rural technology, establishment of a CSIR rural technology gallery and organizing various training programs/awareness programs and Advanced Materials and Processes Research Institute (AMPRI), formerly Regional Research Laboratory, Bhopal has successfully implemented these activities. This paper reveals about the establishment of a gallery consisting of promising CSIR rural technologies which is mainly aimed at popularization.

CSIR Rural Technologies

CSIR has a wide network of 37 laboratories around the country and some of these laboratories, in addition to generating new knowledge, have been making out technologies that will have a special significance for the rural sector. CSIR joins hands with various governments departments and ministries towards meeting the commitment to leverage its relevant knowledge base for the benefit of rural sector, north east region of the country and weaker sections of the society (Vimla, 2007). It has also established new linkages and partnerships by providing technological support for basic human needs of the people living in rural India in key S&T areas of strength.

Rural development through inducting and infusing S&T based innovations in rural life has been a vital mission for CSIR. In this journey it has developed around 365 technologies covering areas like mechanized agriculture, new cultivation techniques, water purification techniques, low cost housing and traditional ceramic products utilizing locale-specific endowments etc. All these technologies are creating lot of employment and wealth generation by improving quality of life and community development. During Eleventh Five Year Plan (2007-2012) of Government of India, CSIR has brought out a focused program called “CSIR 800” which aims at providing a better life to 800 million people in the country by the way of developing cost effective technologies in the areas of health, agriculture, and energy. Apart from providing meaningful solutions, the program largely encourages the successful dissemination of its rural technologies.

Rural Technology Dissemination

Dissemination of rural technologies as such is not the mandate of many CSIR laboratories. But without popularizing its technological base these laboratories can never benefit the rural populations and the issue of effective dissemination has been widely discussed over the years and at various levels. It was during the Tenth Five Year Plan of Government of India, CSIR has brought out program called “Rural Action Program” (RAP) which is largely aimed at showcasing and disseminating the rural technologies (Nandan, 2009). Apart from this, efforts are being made to design successful business models to create sustainable employment.

***Saranjamshala*–The CSIR Rural Gallery**

In the process of its dissemination efforts, CSIR has established a rural gallery named *Saranjamshala*–a name inspired by the Gandhian literature at AMPRI, Bhopal to showcase its prominent rural technologies for their effective outreach. Prof. V.L. Chopra, Member, Planning Commission, Govt. of India inaugurated the gallery, in the presence of Dr. Samir K. Brahmachari, Director General, CSIR on March 28, 2008. The gallery is presently functioning as a CSIR rural technology showcase. The design of the gallery includes 5 theme showcases and 14 individual laboratory showcases. The theme showcases are the places where collective technological models of different laboratories were placed based on various themes viz., Natural Fibers, Leather, Ceramics and Handicrafts, Food Technologies, Medicinal and Aromatic Plants. The individual showcases hold prominent rural technology products/models of the following 14 CSIR laboratories:

1. Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow
2. Indian Institute of Integrated Medicine (IIIM), Jammu
3. Indian Institute of Petroleum (IIP), Dehradun
4. Advanced Materials and Process Research Institute (AMPRI), Bhopal
5. Central Leather Research Institute (CLRI), Chennai
6. Central Scientific Instrument Organizations (CSIO), Chandigarh
7. Central Food Technological Research Institute (CFTRI), Mysore
8. Central Glass and Ceramics Research Institute (CGCRI), Kolkata
9. Institute of Himalayan Bioresource Technology (IHBT), Palampur
10. National Institute for Interdisciplinary Science & Technology (NIIST), Trivandrum
11. Central Mechanical Engineering Research Institute (CMERI), Durgapur
12. Institute of Materials and Minerals Technology (IMMT), Bhubaneshwar
13. Central Building Research Institute (CBRI), Roorkee
14. Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar

Collection of the Exhibits

After the conceptualization of the idea a meeting was held with nodal officers of the respective CSIR laboratories to decide on the structure and exhibits of the display. Exhibits interms of working models, miniaturized models, original products, brochures etc. It was also decided to place scrolling displays in the gallery for providing the technological details about the exhibits.

Exhibition Plan

Soon after finalizing the type of exhibits, information from all the individual laboratories was collected and based on the material, 5 theme showcases and 14 individual laboratory showcases were made. The five theme showcases were designed to showcase the collective technological models of the CSIR laboratories that are working on common areas like natural fibers, leather, ceramics and handicrafts, food technologies, medicinal and aromatic plants. Apart from this, the exhibits supplied by the individual CSIR laboratory were showcased separately in the form of an individual showcase. Technical information in the local language (Hindi) about the exhibits in both the theme and individual laboratory showcases was placed in the scrolling displays which are attached to the showcases.

Promoting the Gallery

A 25 minute video film of the gallery along with a brochure has been made and sent to various State Institute of Rural Development (SIRD), Krishi Vigyan Kendra`s and other major rural development organizations. These organizations are guiding the prospective entrepreneurs and rural artisans to visit the gallery for getting more information. Apart from this workshops and awareness programs on prominent technologies were also conducted for the NGO`s and rural communities. To build more audiences we have popularized the gallery through media.

Support and Networking

To increase the effectiveness of the gallery we are continuously supporting the visitor’s interms of technology transfer and incubation processes. It also involves business meetings with prospective entrepreneurs for preparing sustainable strategies towards marketing and related issues. All these activities are helping us to create a large network of people that are interested to adopt CSIR Rural Technologies.

Conclusion

CSIR is a vibrant institution and rural development has always been a vital mission. It is continuously striving towards the development of promising technologies for rural India and on the other side constantly disseminating its readily available technologies. The CSIR rural gallery “Saranjamshala” is a unique place where prominent technologies were showcased for their effective dissemination.

Acknowledgement

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A Museum for Understanding Biodiversity: The Calicut Initiative

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Abstract. Augmenting the related "Communication, Education and Public Awareness" (CEPA) programmes is a major aspect in enhancing sustainable development and promoting conservation of biodiversity.
Science museums can play a significant role in educating the public on indigenous biodiversity. It is with this objective, that Western Ghats Regional Centre, Zoological Survey of India opened its museum a couple of years ago. The museum is unique of its kind due its special focus on local animal species and is now a prominent point of interest to the student community as well as to the general public.

Keywords. Biodiversity conservation, Calicut, Science musuems, ZSI

Introduction

The United Nations with the declaration of the year 2010 as "The International Year of Biodiversity" has invited the world to celebrate life on earth and the value of biodiversity for our lives. It also reckons a joint action in 2010, to safeguard this 'variety of life' on earth. (http://www.cbd.int/2010/welcome/). For enhancing sustainable development and promoting beneficial conservation of biodiversity, "Communication, Education and Public Awareness" (CEPA) programmes related to biodiversity need to be augmented.

That which is appreciated and valued only, will eventually be saved or conserved. So also understanding what biodiversity is, proves crucial to valuing and conserving it. Attaining a clear understanding about the 'Variety of life' is essential for a critical evaluation of the impacts of human actions on the living world.

Better awareness can be achieved, if initiatives stay focused on local biodiversity aspects. Science museums by explaining and displaying the indigenous biodiversity can play a significant role in educating people on the importance of biodiversity conservation. It is with this objective that the Western Ghats Regional Centre (WGRC), of Zoological Survey of India (ZSI), Calicut, Kerala, commissioned a Museum in September 2008. ZSI, with its headquarters in Kolkata, is a premier organization under the Ministry of Environment and Forests (MoEF), Government of India, and is involved in the study of diversity of animals in the country. The organization conducts faunal surveys, explorations and research leading to the advancement of scientific knowledge on the faunal wealth of the nation.

About the Museum at WGRC, Calicut

The museum at WGRC is unique of its kind due its special focus on local animal species and endemics of Western Ghats (WG), a prime 'Biodiversity Hotspot'. Various displays communicate the current status, vitality, richness and significance of the diversity of animal life of WG. Important concepts in biodiversity which are locally relevant are also presented effectively by maintaining displays of live as well as preserved organisms, through paintings, photographs and also screening short movies. The exhibits set up mainly on a student as well as a layman's perspectives are housed in two floors occupying a total area of about 4500 sq. ft.

In a short span of 2 years since its inception, the museum has attracted a total of 28,749 visitors (as on 24th October, 2010). The museum is open on all week days and entry is free.

All the displays in the museum are thematically arranged. Such a grouping ensures an in depth and focused understanding of the subject to an observer.

Displays are arranged under four thematic categories.

Theme I: Observe nature

Observing nature is a skill requiring attributes like patience and keenness. Displays set up near the entry point demonstrate in particular, the need to develop such attributes as essential prerequisites for observing nature. Model habitats have been set up, where one has to struggle a bit to spot out the creatures placed within. Such displays also help the observer to develop insights on cryptic colourations in animals and explain how a camouflage can really aid an organism in its survival.

Theme II: Wonders of the animal world

Creating enthusiasm in an observer on the topic depends a lot on the content and the presentation style of a display item. For essentially equipping the minds of an observer in appreciating the value of biodiversity, a few among the wonders of the living world have been chosen and displayed.

***The 'living fossils'*:** Living fossils are organisms that have remained unchanged even after millions of years. The mysterious Purple frog, the beautiful Nautilus and King crab along with apt write-ups, convey the concept what 'Living Fossils' are.

***The record breakers*:** The smallest and the largest species of frogs in India, the smallest fish species in India, the largest species of moth in the world, the largest butterfly species in India and one of the longest species of earthworms represent the record breakers in the animal world.

***The 'curious creatures'*:** The stick insect with its deceptive appearance, the leaf insect even mimicking the venations on a leaf, the flying lizard, the flying fish and the chameleon induce an element of curiosity in the minds of an observer, implanting in them an urge to learn more on the living world.

Theme III: Vital concepts

To communicate on some of the vital concepts in the science of Biodiversity, in addition to the preserved examples and photographs, a few living forms have also been displayed.

Concept-I: Invasive alien species (IAS): Among the current threats faced by biodiversity, those posed by the IAS (non-native organisms that cause, or have the potential to cause harm to the environment, economies, or human health) have been ranked the second.

With the two representatives of IAS of the region, viz., the African Cat fish and the Red eared slider turtle, maintained live, also supplemented by adequate data, the concept of the threats posed by the IAS to the indigenous life forms are well- conveyed.

***Concept-II: Endemism*:** An endemic species (an animal or a plant species with habitat restricted to a particular area) is one of the focal topics in biodiversity and conservation sciences.

A live display of one of the most beautiful of the fishes, endemic to the fresh water streams of Western Ghats, the redline torpedo fish, popular by the name "Miss Kerala" has been maintained. This along with the series of preserved specimens of the endemic animals of the region, coupled with display of apt data, imprints in an observer, the importance of the concept of endemism in the field of Biodiversity.

Theme IV: 'A Journey through Western Ghats'

This is the focal theme of the WGRC museum. The first floor is dedicated totally to unveil the rich biological wealth of WG. The section effectively reflects the magnificence and glory of the WG, as well as its faunal diversity, through an elaborate display of representative fauna of the WG, comprising of butterflies, beetles, dragonflies and damselflies, fishes, frogs, tortoises, turtles, snakes and mammals- all supplemented with large, framed photographs and bilingual write ups. The section is equally appealing to a serious researcher as well as a layman and caters information on the data regarding the diversity of the group, conservation status and of general interest.

The video corner, exhibiting short movies on animal life specific to WG generate a lively ambience.

The section also depicts the current threats on biodiversity of WG due to large scale land conversions, overexploitation, poaching and pollution.

Communication, Education and Public Awareness" (CEPA) programmes

As a part of CEPA programmes, the museum also holds regular Poster sessions on contemporary themes viz., 'Climate Change and its Influence on Biodiversity' and IAS. A special publication on WG, a series of brochures highlighting an exhibit each and a variety of colourful stickers on the endemic species are distributed, as supplementary educational aids.
Inspired by the information disseminated by the museum, requests to conduct special lectures, workshops and training sessions on the biodiversity aspects of WG are being received regularly from various institutions, students, teachers and forest officials, which are regularly catered.

Conclusion

The strength of the WGRC museum is its wealth of faunal samples, identified upto species level. Such a museum dedicated to displaying animal diversity at a regional level is the first one of its kind in the state.

The museum is now a prominent point of interest to the student community as well as to the general public. WGRC has also been receiving requests for advisory services from regional as well as national organizations on varied aspects based on the museum. Media coverage and feed backs too in general reflect the success achieved by WGRC in fulfilling the goal of setting up a museum with a difference.

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Science Museums as Facilitators for Linking Science with Society

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Abstract. Today we are at the crossroads of civilization, soon entering into a new era of rapid global industrialization. With this rapid growth of our civilization, India, also despite her progress in many fields, especially science and technology still lacks in evoking scientific temperament *en masse*. Repeated Government plans and policies emphasized an effective science education to make people in general aware of the facts of life in the light of science. Science education grossly lacks the visual inputs essentially needed to inculcate science in the minds of young students. Museums in our society have emerged over the centuries as important organizational components and they are called society's information infrastructure. Their roles and functions, as they have developed over this period, are the expression of a variety of cultural and social practices related to education, research, artistic creativity, entertainment and research. In addition, museums serve as educational institutions both for scholars and general public. Materials from museum are primarily used, to place new knowledge in wider education contexts of all kinds and all levels from kindergarten to university. In the present world scenario, when study is a matter of competition rather than application, a museum can perhaps enlighten the minds of the helpless students by making them learning their subject through fun and enjoyment. The formal education system today does not encourage the natural inquisitiveness essential to nurture proper scientific temperament among the young students who form the bridge between the present and the future. On the other hand the science museums do not contain potential resources to satisfy the querying young minds of the students. The present paper highlights how science museums can adapt themselves to attract the young students and make them learn their subjects in the true science. The study has been made with reference to some notable science museums of West Bengal.

Current status and the future of Chinese Science Museums Websites–A Conclusion based on Content Analysis to the World Wide Web

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Abstract. In 1993, the first science museum website all around the world was set up by the Explorium, San Francisco in US. Then more and more science museums open their doors on the Internet. Since 2005 which year is a milestone of improvement of Internet in China, Chinese science museums have built their websites as well. Technologically, these websites are called digital science museum.

This article focuses on all the information about science in the websites of three most famous science museums. And in this research, Content Analysis to the World Wide Web is an important method to illustrate the point. Based on extensive literatures, a context unit- all pages of 3 websites- are chosen with the right time frame as the target is always moving. And visits on science museums in the city of Beijing, Shanghai and Chongqing can help establish multi-level coding units which are well prepared for data collection. By the challenging way, researchers could solve problems presented as follows. What kind of content do these websites include? How do they show them? How do they express ‘the nature of science’ (NOS)? And what else can they do for audience?

Keywords: Chinese science museums, Content analysis to the World Wide Web, Nature of science

Role of Tocklai's Science Exhibitions and Workshops in Educating Common People and Student Community on Health Benefits and Scientific Upbringing of Tea–A Case Study

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Abstract. Role of exhibition in educating and creating science awareness among student and common people is well recognized. It forms a platform where visitors get ample opportunity to express views and can exchange ideas with experts of relevant fields. Tocklai Experimental Station commonly known as Tocklai was established in the year 1911.Ever since its inception Tocklai promotes R & D in tea and has been serving Tea Industry of North East India and the contribution of Tocklai towards the growth of tea Industry of North East India is well documented. Tocklai has developed 185 new tea cultivars which have been widely used by planters. Agro-technology that has been evolved after a series of experiments is currently used by planters for scientific up upbringing of tea plants, pruning, plucking, manuring, and pest control. Tea processing machineries developed by Tocklai are being used not only by planters in India but also used by planters of other tea growing countries of the world. Process optimization for quality tea production is an applied and practical science which has been accomplished with the establishment of model tea factory in 2004.Hosting of science exhibition is a tradition of Tocklai where all aspects of tea growing, tea manufacturing, tea tasting, pest control measures, identification of natural enemies of pests, including beautifully preserved butterflies of Tocklai museum, different grades of tea are displayed. Health benefits of tea are well displayed in the form of posters. Tocklai has also have a publication i.e official scientific journal,Annual Reports, Quarterly news letter, Tocklai news letter, Memorandum, Field management book etc for growers. Students from schools and colleges pay regular visits to Tocklai and interact with scientists, experts to know the basics of life science with special reference to tea. This paper evaluates a few national exhibitions attended by Tocklai and the knowledge that reached the tea grower, students and common people in respect of tea growing and its consumption.

Relevance of Outreach Activities in Planetarium

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Abstract. The audience in a planetarium show is mostly heterogeneous; you have people from crying babes-in-arms to snoring 80s. Luckily, a majority comprises students. Some of us also make special shows for students. However, astronomy teaching and learning cannot be just a one-show experience only to be waiting for the launch of the next show at the planetarium. This is not enough. In this presentation the word "outreach" means all those activities that a planetarium engages-in beyond its regular show presentations and not necessarily those performed away from the planetarium. Organisation of lectures by eminent astronomers for general public and students, sky watching with telescope, star gazing sessions held far away from city, quiz, painting essay and other competitions not only make the planetarium a place full of activity but keeps those busy for whom it is done. Our aim is to keep children's interest alive all the time. Therefore, we got to work all the time in numerous different ways to reach this goal.

Second Name of Life is Organic Food

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Abstract. Organic refers to an “earth friendly” and health supportive food. Organic grown food is our best way of reducing exposure to toxins used in conventional agricultural practices. These toxins includes not only pesticides many of which have been federally classified as potential cancer causing agents, but also heavy metals such as lead and mercury and solvents like benzene and toluene. Which damage function of our body and cause disease.

Keywords*:* Immunity, Pesticides, Vitamins, nutrients, Non-organic, Toxin, Fungicides, minerals

Introduction

Whether one’s belief is that human life was created by the “big bang” God, our origin is directly connected to the earth below our feet. The body that contains each of us is the only one that we experience. A new one cannot be purchased with all the riches of the world. All the gold in the world will not take the place of health and happiness. Our energy comes directly from what we eat. That food, just like us, is a living entity.

But in the thirst of modernization and industrialization man has contributed pollution to the life and ecology of plants. Increased demand for food has lead to the chemicalisation of agriculture and we have reached on such a stage that modern agriculture is dependent on high yielding varieties, which can only be grown under the influence of fertilizers and pesticides.

The presence of pesticide residues have been detected in various items and in food chain. Even human breast milk is not free from DDT, which was found to have even 2.39 PPM levels. Similarly human blood was found to have a much higher concentration of 12.00 PPM as against of 0.050-PPM safe levels (no effect levels). .

Organic Food

In 1939, Lord Northbourne coined the term *organic farming* in his book *Look to the Land* (1940), out of his conception of "the farm as organism," to describe a holistic, ecologically-balanced approach to farming—in contrast to what he called *chemical farming*, which relied on "imported fertility" and "cannot be self-sufficient nor an organic whole." [(1)]

Defination

Food that is grown and produced by without antibiotics, growth hormones, pesticides or bioengineering is known as organic food.

The pros in 'going organic' is that organic food is free from artificial chemicals, pesticides, antibiotics, growth-promoters and fertilizers. It is produced using environmentally friendly methods and is free from genetically modified ingredients. Organic foods reduce dependence on non-renewable resources and places emphasis on animal welfare[(2)] Organic farming, food quality and human health:

How Do Organic Foods Benefit Cellular Health?

DNA**:** Eating organically grown foods may help to better sustain health since recent test tube animal research suggests that certain agricultural chemicals used in the conventional method of growing food may have the ability to cause genetic mutations that can lead to the development of cancer[3]. One example is pentachlorophenol (PCP) that has been found to be able to cause DNA fragmentation in animals.

***Mitochondria*:**. The chemicals include paraquat, parathion, dinoseb and 2-4-D which have been found to affect the mitochondria and cellular energy production in a variety of ways including increasing membrane permeability, which exposes the mitochondria to damaging free radicals, inhibiting a process known as coupling that is integral to the efficient production of ATP.

***Cell membrane*:** Since certain agricultural chemicals may damage the structure and function of the cellular membrane, eating organically grown foods can help to protect cellular health. The insecticide endosulfan and the herbicide paraquat have been shown to oxidize lipid molecules and therefore may damage the phospholipid component of the cellular membrane.

How Non-Organically Grown Foods are Harmful?

When a large number of pesticides are present and their combined effect has not been measured; which of course will give very dangerous view. Various Pathological effects of low doses of pesticides in animals and man are as under.

***Immunopathological effects*:** Immuno-pathological effects of pesticides in animals and man are classified under acquired immunodeficiency or immunosuppression, autoimmunity and hypersensitivity. Eczema in man was found due to maneb, 2,4-D and 2,4,5-T. DDT has also been known to cause type I hypersensitivity reaction. The dust of pesticides is cause of allergic respiratory disorders like asthama. Cutaneous allergy has been known to occur due to contact of pesticide contaminated food items.

***Carcinogenic effects*:** Most of organochlorine pesticides like dieldrin, gamma isomer of BHC, DDT and PCB may cause cancer in liver and lung. Indirectly, a state of immunosuppression for a longer period is helpful in increasing the susceptibility of an animal for malignancy. Since many pesticides are known to cause mutation in chromosomes of man and animals, it is considered that they may also lead to carcinogenicity.

***Mutagenicity*:** Pesticides may cause alterations in structure or number of chromosomes resulting in translocations, mutations and chromosomal breakage. The altered chromosomal number may become lethal during fetal stage. Several pesticides like DDT, Endrin, PCB and HCB are known to cause chromosomal aberrations.

***Teratogenicity*:** **T**here are certain pesticides which causes teratogenic defects in animals. Carbaryl, thiram, propoxur, parathion, leptaphos, 2,4-D, lindane and diazinon are having teratogenic defects in animals.

***Neuropathy*:** Most of the organophosphates, organochlorines carbamates may cause neutrotoxic effects in man and animals including increased irritation, loss of memory, in coordination of movement, ataxia, delayed response, convulsions, spasms and paralysis. Such changes appear due to demyelination of nerves in central and peripheral nervous system.

***Nephropathy*:** The pesticide residues bind with certain body proteins, they may become antigenic. This antigenicity is responsible for initiation of immune response in body and a continuous presence of antigen and antibodies in body may lead to the formation of immune complexes. The immune complexes when produced in excess are deposited in glomerular basement membrane leading to glomerulonephritis, commonly known as renal failure for which patient needs dialysis after a regular interval to survive.

***Hepatotoxicity*:** The pesticide residues in food may harm liver tissue as they are metabolised here. There are instances of chronic liver disorders leading to cirrhosis. Certain pesticides are not so dangerous but their metabolites cause severe damage to hepatic parenchyma. The cirrhosis once starts; it never stops even after withdrawal of the primary cause.

***Reproductive disorders*:** It has been observed that the pesticides are lethal to dividing cells of genitalia. They may cause abnormalities in sperms leading to decrease their ability for fertilization[4].

On the other hand the ova becomes defective and not able to implant on the uterine surface leading to early abortion or miscarriage.

Why Should You Eat Organic Food?

With organic foods you enjoy a superior taste
Organic foods is superior to conventionally grown foods[5] Organic foods often contain less water than conventionally grown foods and thus have a more concentrated flavor. Because organic items are often grown locally, they "ripen on the vine" and are fresher than conventionally grown foods that are shipped from further away. The difference can be subtle, but it is there

You can avoid toxins by eating organic product

***Pesticides*:** By far the largest group of toxins to be largely prohibited from organically grown foods where as Several hundred different chemicals and several thousand brand-name pesticide products are legally used in commercial food.

***Heavy metals*:** The toxic metals cadmium, lead, and mercury enter the food supply through industrial pollution of soil and groundwater and through machinery used in food processing and packaging
. Cadmium, which can be concentrated in plant tissues at levels higher than those in soil, has been linked to lung, prostate and testicular cancers.

Despite lead's long-recognized serious adverse impact on health, especially that of young children, lead solder is still used to seal tin cans, imparting the lead residues found in many canned foods. Even low levels of lead are harmful and are associated with decreased intelligence, impaired neurobehavioral development, decreased stature and growth, and impaired hearing. Mercury is toxic to brain cells and has been linked to autism and Alzheimer's disease.

***With organic produce you can benefit from extra vitality*:** Organic foods are more alive. This is a hard one to prove, but as fruits and vegetables ripen, they incorporate sunlight and nutrients from the soil and store vital energy. Your body uses this vital energy s well as the vitamins and minerals stored in the food you eat.

***Environmentally, Organic Food Is Gentle On The Earth*:** Water and air are our most important resources. Infiltration of pesticides, herbicides, fertilizers and other soluable chemicals into *surface and groundwater*[6]. Some herbicides actually evaporate into the air after application and drift for miles (still having bad effects on plant life!) and some agricultural chemicals bind to dust particles which you breath in during dust stormsution.[7] Organic farmers do not contribute to water pollution. Organic livestock farms are prohibited from being point sources of nitrate.

***More vitamins And minerals*:** A review of 41 studies comparing the nutritional value of organically to conventionally grown fruits,vegetables and grains also indicates organic crops provide substaially more of several nutrients like 27% more vitamin C 21.1% more iron 29.3% more magnesium 13.6% more phosphorus and higher phytonutrients–plant compounds that can fight cancer–than conventional food.

***More nutrients*:** Here are a few of the nutrients that were found in higher levels in the organic foods:

- Chromium deficiency is associated with the onset of adult diabetes and atherosclerosis (hardening of the arteries). Chromium was found to be higher in organic foods by an average of 78%.
- Selenium is one of the antioxidant nutrients that protect us from damage by environmental chemicals. It is protective against cancers and heart disease. It was found to be an average of 390% higher in organic foods.
- Calcium, needed for strong bones, averaged 63% higher in organics.
- Boron, which has been shown to help prevent osteoporosis (along with calcium), averaged 70% more.
- Lithium, which is used to treat certain types of depression, was 188% higher.
- Magnesium, which reduces mortality from heart attacks, keeps muscles from spasming, and eases the symptoms of PMS, averaged 138% more.
- Aluminum has been implicated for years in the development of Alzheimer's disease. It's content in organic food averaged 40% less that in commercial foods

- Lead toxicity, which has been in the new a lot lately, can adversely affect our children's' IQ. It averaged 29% lower in organic foods.
- Mercury, which can cause neurologic damage, averaged 25% lower in organic foods.

The chemicals actually reduce the amount of nutrients in plants after application like vitamin C, beta carotene, and the B vitamins. *Betacarotene* has been shown to be a stimulant of the immune system, and is sometimes able to prevent lung cancer. They have very clearly shown that chemical residues in the serum and fat cells of women greatly increase the risk of breast cancer.

Table.1 Trace elements present in organic and non organic food

Percentage of Dry Weight				**Quantities per 100 Grams Dry Weight**				**Trace Elements. Parts per million Dry matter**			
Vegetable:	Mineral Ash	Phosphorus	Calcium	Magnesium	Potassium	Sodium	Boron	Manganese	Iron	Copper	Cobalt
Snap Beans Organic Non-organic	10.45 4.04	0.36 0.22	40.5 15.5	60 14.8	99.7 29.1	8.6 0.9	73 10	60 2	227 10	69 3	0.26 0
Cabbage Organic Non-organic	10.38 6.12	0.38 0.18	60 17.5	43.6 13.6	148.3 33.7	20.4 0.8	42 7	13 2	94 20	48 0.4	0.15 0
Lettuce Organic Non-organic	24.48 7.01	0.43 0.22	71 16	49.3 13.1	176.5 53.7	12.2 0	37 6	169 1	516 9	60 3	0.19 0
Tomatoes Organic Non-organic	14.2 6.07	0.35 0.16	23 4.5	59.2 4.5	148.3 58.8	6.5 0	36 3	68 1	193 8 1	53 0	0.63 0
Spinach Organic Non-organic	28.56 12.38	0.52 0.27	96 47.5	203.9 46.9	237 84.6	69.5 0	88 12	117 1	158 4 49	32 0.3	0.25 0.2

Recovery from cancer: Tests with people and animals eating organic food show it makes a real difference to health, and alternative cancer therapies have achieved good results relying on the exclusive consumption of organic food. The review [19) cites recent clinical evidence from doctors and nutritionists administering "alternative" cancer treatments, who have observed that a completely organic diet is essential for a successful outcome.

Quality of soil: This was attributed primarily to differences in soil fertility management and its effects on soil ecology and plant metabolism. Organic crops contained significantly more nutrients -vitamin C, iron, magnesium and phosphorus - and significantly less nitrates (a toxic compound) than conventional crops(6).

***Antioxidant*:** The data show that organically grown fruits, and, to a lesser extent, vegetables, contain higher levels of secondary metabolites known as antioxidants and polyphenolics than conventionally grown fruits and vegetables.(8) Current available research shows that these chemicals may prevent heart disease, certain types of cancer, and other mutagenic, oxidative disease processes of the human body.

Protect children: In the aftermath of the Alar scare of the 1980's, a study concluded that the average child is exposed to four times as many cancer causing pesticides in food than are adults, based on the types of foods children are most likely to eat[9] Food choice can have a substantial effect on a child's future health.

***Saves energy*: **Organic farming is accomplished by less energy consumption. Inputs like fertilizer are naturally occurring and require less processing than substances manufactured by huge chemical companies. Organic food generally travels less miles from farm to market saving energy in transport. Whereas organic farmers incorporate alternative and renewable energy sources into their farming/home steading systems[10].

Many hidden costs are involved with the buying of conventionally produced food products. These hidden costs include billions of dollars in federal agriculture and energy subsides favoring big business. Chemical regulation and testing, hazardous waste disposal, environmental damage, cleanup, illnesses and hospitalizations are other hidden costs. Low prices of conventional foods are also a signal that the farm workers did not receive a fair wage.

***Yield*: **One study found a 20% smaller yield from organic farms using 50% less fertilizer and 97% less pesticide.[Studies comparing yields have had mixed results. Supporters claim that organically managed soil has a higher quality[11] and higher water retention. This may help increase yields for organic farms in drought years.

Pesticides and Farmers

There are studies detailing the effects and side effects of pesticides upon the health of farm workers as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems.[12] In addition, there have been many other studies that have found pesticide exposure is associated with more severe health problems such as respiratory problems, memory disorders, dermatologic conditions,[13]18 cancer, depression, neurologic deficits, miscarriages, and birth defects.

Table 2. Differences between food grown in an organic manner and food grown by conventional farming

Fact	Non Organic Food	Organic Food
Nutrients	During processing, non organic foods lose some nutrients and such nutrients have to be artificially added back to the food.	Organic foods contain more nutrients, that is, a higher amount of minerals and vitamin C.
Fertilizers	Chemical fertilizers are used to provide nutrients for the growth of crops in conventional farming.	Natural fertilizers like green manure and compost are used for the plants and soil in organic farming.
Pesticides	In conventional farming, there are over 450 pesticides which are permitted for use. Many of these pesticides are toxic.	Pesticides are not allowed in organic gardening or farming
Herbicides	Herbicides are used in non organic farming to protect crops from insects and weeds. Herbicides sometimes leave a harmful toxic residue on the plants.	Methods like crop rotation and hand weeding are used instead of herbicides in organic gardening and farming.
Sewage Sludge	Human waste is used as a fertilizer to grow crops in conventional farming. This contaminated sewage sludge may cause diseases.	Use of sewage sludge is not permitted in organic farming.
Nitrate Amount	Fertilizers contain nitrate as a common ingredient and this nitrate gets converted to nitrosamines, which may be retained in the food and be cancer causing.	Organic food contains lesser amount of nitrates in it.
Environment Pollution	Use of pesticides damages aquatic life. Herbicides and pesticides contain toxic chemicals, which has resulted in lesser number of birds, insects and wild plants on the	Organic farming uses crop rotation to prevent pests, by creating a more diverse ecological system to naturally grow the pest's predators. For increasing the quality of soil, natural

	farmland. Earthworms are essential for good soil health and using pesticides and insecticides reduce earthworm population. This leads to increased dependence of the soil, on pesticides.	manure and composting is done. Thus, the benefits of organic farming are more long term and benefit in fighting problems like degradation of the environment.
Food Safety	Many a times harmful preservatives are added to non organic foods.	Organic foods are safer and better, as they don't use any toxic chemicals.
Number of Consumers	Maximum consumers buy non organic food, as it is cheaper and easily available.	Consumers are shifting towards buying organic foods, with growing awareness.

***Cost*:** Most organic food costs more than conventional food products. Higher prices are due to more expensive farming practices and lower crop yields. but the costs of not eating organic can be even bigger as you will likely have higher healthcare bills and a lifetime of disease and illness. These and many other health benefits of organic foods have been brought to the attention of the UK government [(14)] Over the course of weeks, months, years, and decades, the toxins accumulate and the consequences can be drastic. If and when you reach the point of disease, you may wonder why you're suddenly sick. However, it wasn't sudden at all and maybe that's something you should consider next time you're buying food. So eat oraganic food, keep healthy and live a long life.

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Fundamental Rights Encompassing Science Journalism

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Abstract. Journalism is a means of generating concepts of life. Many science journalists work only for earning their livelihood, but it could be different with some others. The press has a responsibility to impart the best of knowledge and also to develop ethics and values in the readers. The need of the hour is a new concept of science journalism, an independent journalism with specific rules and knowledge.

It is well versed that the Indian civilization is quite old and is a treasure of philosophical values. The fundamental rights given to an Indian citizen by the constitution is a step towards self development and inculcation of historic values. An average media person has values and is well equipped with all the techniques of journalism. In science writing his knowledge should be specific and value oriented. He may or may not agree with a scientist on one hand and a human activist on another. A science journalist shall also be acquainted with what is science and its economic values. In the present paper, we have analyzed the requisites of science journalism in context to the constitutional values.

Modern and Ancient Sciences to go Hand In Hand

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Abstract. India is a land of ancient and diverse traditions. The knowledge flows from Vedas and various other texts which have been passed down the generations. The science was practiced by the vedic people long before the modern technology was introduced. Native or traditional knowledge is a metaphor for what happens when humans experience and participate with the natural world. Indigenous knowledge is not static and hence modern science. It has sacredness, livingness and soul. It is also helpful in survival of the cultural identity. Indigenous knowledge is also evolving and new knowledge is generated from the traditional knowledge and hence modern science. Contemporary scientific knowledge denies the relevance of traditional knowledge and sees this knowledge as a means of denoting all that they know imposes a way of life on them that is shackled to the past and does not allow them to change. If this ancient knowledge can be used as a foundation to modern science in students understanding of scientific concepts, it will be much easier as it will provide a well recognized spontaneous knowledge. The richness and complexity of local knowledge systems derive principally from the fact that they incorporate two very different world views. In the present paper, we have cited examples from the vedic texts that can be incorporated in the teaching of modern science and analyzed how simple it can be to teach modern science with examples and concepts from our traditional texts.

Science Education and Advertisements

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Abstract. Today in modern world everybody runs behind the fake and it has generally become a trend both in fashion as well as in education. This trend has also affected the students. Scientific temper describes an attitude which involves the application of logic and evidence of basic and pre-conceived notion. Discussion argument and analysis and research are vital parts of scientific temper. Today we find a decrease in scientific temper and science is disappearing from the priority list of students. Students study in science stream up to a certain level and then change their stream because of insufficient knowledge of the fascinations of science. Everywhere, we see advertisements attracting a student for a career in engineering or management claiming high results. Is there any advertisement or any other communication to the student about perspective careers in science and what role do scientists play in building the society. In the present paper, we have carried out a detailed study of the measures required to inculcate scientific temper in the students and to communicate the fascinating prospects of career options in science.

Study on the Strategies for Science Museums to Develop the Public's Scientific Literacy

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Abstract. As one of the most important places for science popularization, science museums undertake an important task to enhance scientific literacy of the nation. But so far, it's still not clear about the concept of scientific literacy, and how to establish a clear path for reinforcing quality education. Considering the experiences of education activities for science museum, the authors try to give an concrete, easily operated concept to "scientific literacy", three dimensions for which including scientific thinking, scientific spirit and scientific approaches are discussed in detail. The authors divided scientific thinking into two levels in this paper. The first level was considered as the reasonable ideas about the general law governing the nature and the existence and development of human society, such as the thoughts about materialism, development and universal constant. The second level was considered as the scientific consciousness and the way of thinking embodied in people's activities about science research, technology development and industrial innovation, such as the crisis consciousness, economy consciousness, critical thinking, reverse thinking and so on. The analysis and division will help transformation of the abstract scientific ideas into specific content to facilitate the implementation. This will contribute very much to audience education in science museums. Science museums can cultivate the scientific thinking by organizing various activities, such as the debate, the science drama and the role playing games. The spirit of science is also divided into two levels: the first level is considered as the spirit when we deal with the relationship between the human and the nature, such as the brave exploration spirit, the skeptical spirit, the critical spirit and so on; the second level is considered as the spirit when we deal with the relationship between the humans, such as the cooperation spirit, the wolf spirit, the tolerance spirit and so on. Thus, abstract spirits of science have been materialized into the concrete ideas to facilitate the implementation. Science museums can cultivate the spirit of science by the organization of lively forms of activities, such as the scientific experiments, the outward development and other games. The scientific approaches are divided into three levels: the first level is the basic method each subject disciplines used, as the spectrometry widely used in the physics; the second level is the universal method used by all science researches, such as the empirical method, the numerical method, the logical reasoning and so on; the highest level is the philosophic method, which regarded as the guidelines, such as the method of case by case. Thus, abstract science approaches have been materialized and carried out. Furthermore, through cognitive and psychological analysis, the authors divided the visitors in the museums into five types: the children, the teenagers, the youngsters, the middle-aged and the old folks. The detailed and feasible suggestions are put forward to enhance different people's qualities by educational activities in science museums.

Keywords: Scientific literacy, Science center, Objective, Measure

Science Theatre: A Novel Tool for HIV Interventions in South Africa

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Abstract. Science communicators are playing an increasingly active role addressing societal problems where science and human behaviour play roles. HIV AIDS is amongst these problems, and is particularly acute in South Africa. This paper investigates whether an HIV science theatre show influenced HIV associated intentions and behaviour of South African youth (n=697). The theatre piece significantly changed intentions, while gender, age, rural/urban background and audience response all influenced change. Provisional evidence of behaviour change was found 2-4 weeks later. These results have implications for science theatre as a behavioural change agent and science communicators' roles in addressing society's big problems.

Keywords: HIV/AIDS, Science theatre, Science centre, Youth, Intention, Behaviour change

Science Theatre as a Change Agent

The interface of science and society is where much of science communication activity is focused. Increasingly, that focus is being called upon to raise awareness of societal issues where people's behaviour has a large bearing on a problem – climate change and HIV/AIDS being prominent examples. The aim of such efforts is to give people greater awareness of the science and provide information in engaging ways so they can make informed decisions. Where the scientific consensus is largely polarised and suggests action, such as with human contributions to climate change, science communicators sometimes aim to foster behavioural change.

Science theatre is an underutilised format in behaviour change communication. Science theatre can be broadly divided into two types: stage plays, often with a historical basis, such as Michael Frayn's *Copenhagen*; and demonstration-based science 'shows' which are commonly performed in science centres. In this paper, science theatre is used in the latter context. Science theatre has huge potential as a change agent as it has been shown to facilitate learning and positively influence attitudes [1,2], be amongst the most memorable parts of science centre and museum visits [3], and foster emotional engagement [4]. Moreover, it is widely practiced, adaptable to most topics and able to incorporate aspects of behaviour change theory such as modeling desirable attitudes and behaviours. Despite its apparent power, however, science theatre is rarely used to directly influence specific behaviours. Research in this area could not be found in the literature. In contrast, traditional theatre approaches have been shown to be effective in promoting behavioral change, including behaviours associated with HIV [5,6]. This begs the question: can science theatre be a tool for HIV behaviour change? This is the central concern of this paper.

This paper investigates a novel HIV AIDS intervention targeting high school students visiting a science centre in South Africa's KwaZulu-Natal (KZN) province. The research focused on attitude and intention changes from an HIV AIDS science theatre show, which formed the intervention's major component. It also gathered provisional evidence of actual behavior change 2-4 weeks later.

HIV/AIDS in South Africa

South Africa has the largest HIV epidemic globally, with an estimated 5.7 million people HIV positive and 18.1% average prevalence as of 2007 [7]. The human toll of the epidemic is profound: in 2007 approximately 950 people died each day; 1.4 million children under 17 were AIDS-orphans having lost one or both parents; and 460 000 people were receiving HIV drug treatment, although 1.7 million needed it. After a history of government mismanagement of the problem [8], recent developments have been more positive with a national prevention and treatment campaign launched during 2010 and promising behaviour changes, especially amongst youth [9].

South Africa's KZN province, where the current research was conducted, has been hit hard by the epidemic. Of the nine provinces, KZN has the second highest number of new infections with 134 000 annually [10]. Prevalence in rural areas very close to the science centre studied in this paper show "some of the highest population-based infection rates yet documented worldwide", with 27% of females and 13.5% of males HIV-positive [11].

Within the South African epidemic, youth are disproportionately affected, yet offer some of the most promising opportunities for behavioural interventions. As most HIV infections occur in adolescents and young adults [7], reaching them before and during this stage is critical. A national study found 34% of new HIV infections occur within the 15-24 year age bracket, with females accounting for 90% of those infections [10]. In rural KZN close to the science centre, comparing those aged 15-19 and 20-29 is startling, prevalence rising from 11.2% to 40.5% for females and 2.4% to 29.8% for males [11]. The same study reported that 13 times the number of females compared to males were infected among 15-19 year olds. Clearly, effective interventions targeting high school age students could have a huge impact, both in keeping youth HIV-negative and developing knowledge and behaviours to keep them so in the longer term.

Given South African science centres' clientele are typically school groups, they provide a novel way to deliver science-based HIV AIDS interventions. These interventions can communicate information around HIV risk behaviours, while also exploring the science behind HIV, the immune system, and so on. The intervention studied here addressed all these aspects, while the research focused on behavioural intentions and outcomes.

Behaviours associated with HIV in South African youth

HIV behaviours can be broken into those that prevent/risk HIV transmission (HIV risk behaviours, such as condom use) and those related to HIV (HIV related behaviours, such as discussing HIV). Both were investigated in this study.

Unsafe sexual behaviour groups together a number of HIV risk behaviours and is by far the main vector for HIV transmission in South African youth [12,13]. Approaches to address this in adolescents usually promote abstinence and encourage youth that are sexually active to use condoms and not have multiple concurrent partners – a well known example in South Africa is the 'ABC' campaign which used the mantra 'Abstain, Be faithful, Condomise'. The intervention under study used a similar approach, primarily promoting abstinence, with using condoms and not having multiple partners as secondary messages. The balance of these three messages was tweaked accordingly depending on age groups. The logic was that a clear primary message of abstinence could have the greatest effects, however messages on multiple partnering and condoms were needed for those who would not abstain. Another concern was that focusing on condom use primarily could send a message that to protect oneself from HIV one need not abstain so long as condoms are used. This is true in theory, but evidence suggests it does not work in practice. The gap between awareness and behaviour is large–one study of KZN Grade 11 students found 85% of students agreed that it was important to use condoms every time and 86.4% said it protected them from sexually transmitted infections, yet only 46.2% reported actually using them every time [14].

HIV-related behaviours are also important in addressing HIV AIDS and are mainly related to discussion and openness of the issue. They include reducing HIV's stigma, talking about HIV, increasing awareness of treatment, encouraging testing, and knowing one's HIV-status. These aspects were also dealt with in the theatre show and research.

Method

A science theatre show *The Alarming AIDS Adventure* was presented to secondary school groups visiting the University of Zululand Science Centre. The show was the main intervention component, however also included were an HIV game, career advice, and a regular science centre visit. Other elements are in development.

The theatre show follows two characters – a curious student and knowledgeable scientist – as they learn about HIV through multimedia, models, and demonstrations. It was presented in both English and isiZulu language depending on audiences. Content covered HIV behaviors, the immune system, viruses, HIV biology/genetics, and the related aspects previously outlined. The plot climaxes as the audience are shrunk and taken into the body of a person engaging in risky behaviours to track down HIV. The show concludes with a 20-volunteer demonstration highlighting the behaviours that spread HIV.

Students completed pre- and post-show surveys mainly containing 5-point likert-items on intentions; the post survey also assessed audience ratings of the show (i.e. interest, understanding) and some open-ended questions on behavioural intention. Integrated models of health/HIV behaviour place intention as the end point for other influencing factors and as the key predictor of behaviour [15,16]. Hence intention was the primary research focus, however, other factors that lead to forming intentions were also considered including attitudes, self-efficacy, self-reported knowledge, and normative pressures – all henceforth referred to as intention. Demographic information including age, gender and geographic background (rural or urban/township) was also recorded. Follow-up research investigating actual behaviour and impacts comprised an additional survey and focus groups. To promote open discussion these were run separately for male and female students by a local facilitator of the same gender.

The Australian National University Human Research Ethics Committee approved the research. Consent was gained from teachers and students.

Results

Sample

As many as 697 students completed the final survey, following piloting and survey refinement. The sample included approximately equivalent numbers of males (n=337) and females (n=351), and twice as many urban (n=456) compared to rural students (n=241), as shown in Table 1.

Table 1. Sample demographics

	unknown	female	male	total
rural	1	113	127	241
urban	8	238	210	456
total	9	351	337	697

Follow-up research involved 19 students from two schools, one rural (seven females; two males) and one urban (five females; five males).

Changes in intention

Statistical tests of pre and post survey scores were used to determine significant changes in intention toward HIV risk and HIV related behaviours. Most intentions showed highly significant changes, including resisting peer pressure, wanting to learn more, knowledge of transmission methods, talking to family, and two measures each of abstinence and self-efficacy. Condom use and having an HIV test were of borderline significance, while being worried about catching HIV, talking to friends about HIV, thinking unprotected sex was OK, and trying to get more information on HIV were non-significant. While scores for non-significant items indicated safe or desirable intentions, they point to areas where the show could be refined.

Factors influencing intention change

Modelling was used to determine which factors contributed to post-intention, and hence intention change. Post-intention was largely determined by pre-intention, that is, student’s initial baselines were the greatest factor for their final intentions. Importantly, however, four of the student’s ratings of the show also significantly predicted the post-intention scores – more positive ratings of the show led to greater changes in intention. The contribution of show ratings to post-intention was, however, more modest when compared to pre-intention. Significant rating items were student’s interest, enjoyment, self-reported learning, and understanding. In summary, this suggests that although prior intention is the greatest contributor to final intention, nevertheless interest, enjoyment, and self-reported learning/understanding are all also associated with intention change. It is important to note that demographic variables had indirect effects on intention change via all the factors mentioned above, as is explained below.

Demographic effects

A number of statistical techniques were used to assess demographic differences and how these differences influenced intention change. Demographic differences were evident in both initial intentions and ratings of the show, and hence played a major role in intention change.

Looking generally at intentions, females had more positive intentions than males, and gender differences were large in urban students and almost absent in rural students. Urban students had more positive intentions than rural students, and these differences were greater in females compared to males.

Turning to show ratings, a similar pattern emerged. Rural students gave significantly less positive show ratings than urban across all four rating measures significant for change, while males showed significantly less positive scores on two of the four measures.

Age also showed significant differences across almost all intentions and significant ratings. In general, younger students had more positive results and this declined with age, trending to more negative results for about 15 years and above.

Taken together, demographic variables were critical in understanding how intention changed as they affected both initial intentions and show ratings. Females were more positive than males; urban were more positive than rural; and students younger than 15 were more positive than those older. The implications of this point are taken up below.

Follow-up research

The focus groups and follow-up surveys provided evidence of HIV risk and HIV related behaviour change two to four weeks after the show. Data was largely qualitative in nature and is illustrated by indicative quotes.

When asked if students had been reminded of the show by life events: “Yes, I was at a party at night and I’ve got a boyfriend, [and] he wanted to have sex with me, then I refused because of getting HIV” (20 year old urban female).

However the show was by no means 100% effective, though still had positive effects: “After the show I was blank in mind one day and I had unprotected sex, after that I was blaming myself remembering how the disease work” (18 year old urban male); “I will touch my boyfriend in other ways now, not like previous” (14 year old rural female).

The interviews also indicated students were seeking further information, discussing HIV with family and friends and choosing single partner relationships. It should be noted the follow-up research was provisional in nature and detailed analysis of focus group transcripts is ongoing.

Discussion and Implications

This study provides evidence on the power of science theatre as an intervention to change behaviour, and the effectiveness of rolling out such interventions through science centres. The research shows that the theatre show was able to influence a range of intentions associated with HIV AIDS across a large sample, and this contributed to behavioural change in the short term. Moreover, it elucidates factors that are important for understanding intentions in this context, namely initial intentions and their underlying facets, elements (ratings) of a show that facilitate change, and the role of demographic variables. These three factors should be considered when designing and developing science theatre based behavioural interventions.

First, having knowledge of the current behaviour and intention of your audience is important for design and delivery of the intervention [17]. This study looked primarily at behavioural intention, however deeper knowledge of the factors that contribute to intention will be helpful for any intervention. These include some of those studied here such as attitudes, normative pressures and self-efficacy, which, amongst others, have been shown to be important to behaviour in a range of contexts including HIV AIDS and those affecting the environment [16,18,19]. A limitation of this study is that factors that facilitate translation of intention into behaviour, including behavioural skills and external barriers/promoters, have not *yet* been seriously tackled in this intervention and hence were not researched. These remain crucial elements for truly effective behavioural interventions. Understanding all these elements, either through formal formative evaluation or informal methods, will allow science communicators to more effectively change behaviour.

Second, the result that certain features of the theatre show–namely interest, enjoyment, self-reported learning, and understanding–were important to facilitating change is a significant finding. While anecdotally acknowledged as good features for any theatre show, this is the first research to demonstrate that audience interest and enjoyment can contribute to intention change during a science theatre show. Interest and enjoyment are the emotions thought to work together in intrinsic motivation [20], so in one respect this result is not surprising. It does however highlight the need for science theatre presenters to heed the role of emotions, especially that of interest and enjoyment, in not only engaging but also motivating change. The significance of ratings of self-reported learning and understanding in the change model could mean several things: it could be the feeling of understanding and competence, or actual learning, or both, is important for change. This stresses the obvious need for appropriately pitched shows, but links between actual learning and intention change require further research.

Third, results that different demographics have significantly different starting points and responses (ratings) have implications for development of the theatre itself and adjunct components of the overall intervention. In this study, rural, male, and older students had less positive initial intentions and gave less positive ratings of the show, which contributed to less positive final intentions. Careful examination of which intentions (which is beyond this paper's scope) would allow targeted modifications to the show for different audiences. Another possibility is additional intervention components which target a particular behaviour, for all or just selected demographics as necessary. One example from this research is the behaviour of taking an HIV test, which could be addressed via a workshop or exhibit. It should be noted, however, that in addressing male-specific problems this is not done at the expense of females, especially given the drastically higher risk of contracting HIV for South African adolescent females.

Broader Implications for Behaviour Change Programs–a Call to Action

This study has implications for the role of science theatre, centres and communicators in addressing societal problems where behaviours are key. HIV AIDS and climate change are but two examples of major problems where awareness of the science involved can be leveraged to promote behaviour change. Too often, science centres and communicators feel their remit is to educate, raise awareness and sometimes engage emotionally around scientific issues. This is not to downplay the importance of these aims, but to emphasise that in some cases there is a moral imperative to do more. Science centres are well placed to address these issues; they have the infrastructure, human resources, audiences and skills to deliver interventions. Of course, changing people's behaviour is not to be approached trivially and there is a fine ethical line between sensible guidance based on science and opinion-driven manipulation. All that said, few would challenge the ethics of leveraging scientific awareness to promote behaviours to keep youth safe from HIV, or allow people to contribute to mitigating climate change through responsible environmental behaviours. These are areas where the science is for the most part polarised, hence one can argue for science communicators to present the facts and the implications they have for people's behaviour, allowing people to make informed decisions. In this way, science communicators can become agents for behavioural change.

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China Popularization of Science and Technology (PST) Infrastructure Development and Trends

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Abstract. The popularization of Science and technology(PST) infrastructures are important public service platforms for science and technology popularization, which including six main major categories as following: natural science museums, science and technology education bases, grassroots PST infrastructures, internet PST infrastructures, science popularization caravans and science and technology museums. In 2006 the Chinese Government promulgated the” Outline of National scientific literacy action program”, and PST infrastructure construction project was taken as one of the four basic projects in the outline. Subsequently "PST infrastructure development plan" was issued to promote a comprehensive, coordinated and sustainable development for China's PST infrastructure, and then to provide the PST service support for enhancing of civic scientific literacy.

In 2009, for the first time, China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China’s PST infrastructure development status. Firstly, the author studied and established the overall evaluation index system for China's PST infrastructure development and six separate assessment index system for each category of PST infrastructure.Secondly,by using these evaluation index, Monitoring and evaluation on PST infrastructure was carried out and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status was obtained. At last, a series of further analysis on both successful case studies and reasons for major problems were conducted, and then the Author proposed several solutions on relevant issues. On The basis of this study, Report on Development of China PST infrastructures in 2009, as the first annual report, was completed and officially published. These results can not only lay a solid foundation for annual monitoring and evaluation of China’s PST infrastructure project in future, but also provide policy making support for accelerating China’s PST infrastructure construction. And the author believes this research will be a precious reference for other countries and regions in PST infrastructure development.

Keywords: Popularization of science and technology (PST), Infrastructures, Development status and trend, Monitoring and evaluation, Index system

Learning Science in Interactive Ways at the uMthatha Science Festival: Beyond the Classroom Walls

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Abstract. Grahamstown is renowned for its national science festival (Scifest). The festival includes various activities such as workshops, talks/lectures, exhibitions, shows, experiments and so on. These activities are co-ordinated by Scifest Africa. The aim of the national science festival is to demystify and make science, technology, mathematics and engineering accessible to school learners and members of the community.

A major challenge for an event of this nature, advertised at the national language, is that learners in township and rural schools outside Grahamstown are unable to attend Scifest due to financial constraints. As an attempt to address this problem, the idea of regional festivals was mooted. Scifest Africa approached the Embassy of Finland for funding, with which it has strong links. The partnership between Scifest Africa and the Department of Education, supported by the foreign donors, led to the organisation of the first regional festival, which was held in uMthatha in 2008.

Following the success of the event, the new director of Scifest Africa secured funding from the Embassy of Finland for another regional festival. An evaluation of the event was commissioned to the leading authors of the present paper, to bring an external perspective. The goal was to identify challenges and areas for improvement in order to turn the regional festival into an annual event like the national science festival in Grahamstown. This paper reports on the evaluation of the 2009 uMthatha regional festival, whose specific target group was grade 10 – 11 learners in the uMthatha region.

Data were gathered through using questionnaires, informal semi-structured interviews and focus group discussions, field notes and reflections. To make the evaluation participative and to enhance its validity, questionnaires were given to the organizers (to get an insider perspective about this initiative), the presenters, educators and learners. The evaluation sought to establish the quality of the experiences of all the participants.

The mutual collaboration between Scifest Africa as the main organizers and the DoE officials contributed to the high quality of the event by providing support for presenters. In order to improve learners' experiences of the event, two key challenges need to be addressed: lack of subject content knowledge (this was apparent particularly in areas such as physics) and the language barrier. The latter point could be addressed by diversifying the composition of presenters to include speakers of isiXhosa, the mother tongue of most learners. The use of metaphors and analogies proved to be helpful in encouraging learner engagement, but needed to be made more relevant to the learners' everyday lives (Smit, 1998; Kasanda, Gaoseb & Lubben, 2002). This evaluation indicated that there is a great potential to develop meaningful learning through events such as science festivals, provided that follow-up support is given to educators and learners in their school contexts. By the time of the conference, analysis of the data will be completed and more insights will be available.

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Motivator, Supporter, Trainer: Science Centres and their Role with Primary School Teachers

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Abstract. Can informal science education institutions (ISIs) influence the self-efficacy of pre-service and in-service primary school teachers? The results of this research showed that four hours of science centre style workshops increased the science teaching self-efficacy of pre-service and in-service teachers, with observable results for at least 11 months after the completion of the workshops. Participants identified science centres as a source of inspiration, support and training for teachers. Science centres, and arguably other ISIs, can positively influence the science teaching self-efficacy of teachers with long term effects, and partnerships between the two sectors could enact positive reforms within science education.

Keywords: Informal education, Primary teachers, Science teaching, Self-efficacy beliefs

Introduction

Australian primary school science is often neglected, receiving less than three percent of total teaching time in the classroom [1]. Teachers acknowledge that they do not feel adequately prepared to teach science [15], some even admitting they fear it [2,16]. This is not limited to beginning or novice teachers. Highly experienced Australian primary teachers are just as likely to lack confidence in their ability to teach science as those teachers in their first few years of teaching [24].

A consequence of this science avoidance is a body of students who are disinterested and disengaged in science. Science education is no longer just about creating the next generation of scientists. It is vital for ensuring the scientific literacy of society [9], enabling them to adequately function in a rapidly evolving technological age. Yet science education is falling short, on all counts.

Research has found that student disengagement with science begins as early as primary school, and is compounded in high school [22]. A study of student outcomes in science high schools in Victoria, Australia, found that the single biggest influence on student achievement in science was the teacher[35]. Successful educational reform is dependent on teacher change [32].

Self-efficacy beliefs of teachers

Teachers' science teaching self-efficacy beliefs have been identified as one of the most consistent characteristics researchers can use to evaluate teaching and learning, including as a predictor of teacher behaviour [13,40]. Although many studies have examined the science teaching self-efficacy beliefs of in-service teachers [see for example 33,41], much less is known about the beliefs of pre-service and beginning teachers [7,23].

The concept of self-efficacy was introduced by Bandura [5], who described two different aspects of self-efficacy: 'efficacy expectation' which deals with an individual's belief in their ability to achieve a desired outcome or behaviour; and 'outcome expectancy' which describes the individual's belief that the achievement of the desired behaviour will have a desirable outcome. Riggs and Enochs developed the Science Teaching Efficacy Belief Instrument based on Bandura's efficacy concept, facilitating examination of these beliefs of in-service [33] and pre-service [11] teachers.

Understanding the environmental influence on teachers' beliefs is crucial for evaluating the influences on teachers' beliefs and practice [21,23]. The effectiveness of professional development undertaken by teachers within the same environmental context has been found to be more effective than the results seen with disparate groups of teachers [29]. Few studies have examined the impact of the school environment on a science teacher or vice versa, limiting our understanding of how to achieve science education reform [23]. The potential influence of the informal environment, such as that of informal science institutions (ISIs) should also be considered.

Informal education–a potential solution?

The main aim of ISIs is to increase the general public's awareness, enjoyment and excitement about science [37]. One of the biggest challenges for ISIs is engaging and motivating reluctant teachers of science [20].

Typically, ISIs employ constructivist principles in their content and programming, using hands on activities to allow construction of ideas and knowledge though personal experience [38]. Constructivist principles recognise the prior experiences of learners, acknowledging that any new experiences will be framed in the context of prior knowledge and experience [18]. A constructivist approach defines learning as having occurred "…when there is a connection between thought and experience" [27].

Although our understanding of the learning processes and outcomes that occur in museums and other informal education environments has been improved and increasingly well documented in the last few decades [39], little is still known about the impact of ISIs, particularly in the area of teacher training or professional development (PD) [3].

Of those studies that have examined the effects and impacts of PD delivered by ISIs, the results indicate positive outcomes [25]. Perera found that one day science PD workshops modelled on constructivist principles were capable of facilitating conceptual change in teachers [30]. This is in contrast to other evaluations, which found that the results of science based PD delivered via formal means do not show the same levels of success as those attained in other subject areas [19], irrespective of the duration of the PD activity [10].

In a survey of their preferred science PD characteristics, teachers overwhelmingly asked for it to be delivered by an outside expert, and to contain practical ideas and activities [4]. ISIs are already considered by many teachers to be experts [12]. Previous studies have shown that partnerships between ISIs and schools are capable of facilitating student engagement in science [17]; others strongly advocate for these partnerships as a new way forward for achieving science education reform [39].

The aim of this research was to examine if PD workshops from a science centre could influence the science teaching self-efficacy beliefs of pre-service and in-service teachers. The workshops used constructivist principles as the basis for engagement, with the emphasis on participants exploring the activities and learning about science "…with the same methods and strategies as students should learn science in schools" [31:p190].

The research presented here was part of a larger doctoral study. The research questions examined in this paper are:
(1) Do science centre style, short PD workshops have any effect on pre-service and in-service teachers' science teaching self-efficacy?
(2) Is there a role for informal science education institutions, like science centres, with teachers?

Research Method

Eight pre-service teachers in the final year of their degree and 13 in-service teachers (six from a New South Wales-NSW-school, seven from an Australian Capital Territory-ACT-school) with varying levels of experience participated in this year long study. Each cohort contained one male, the rest of the participants were female. Pseudonyms are used in the presentations of these results. Each participant completed a series of four workshops developed by a science centre, on topics such as fluids, climate change, music and sound and physics. Each workshop consisted of around 10 hands-on activities using simple, every day materials to demonstrate a scientific principle.

Participants completed an initial STEBI survey (STEBI A for in-service, STEBI B for pre-service) prior to the workshops to gather the baseline of their efficacy beliefs (Period 1). The STEBI surveys were administered again immediately after the series of four workshops were completed (Period 2), then four months (Period 3) and 11 months after completion (Period 4). At the final sample period (Period 4) the pre-service participants were given the STEBI A instead of the B, as they were now teaching schools. Both STEBI instruments have been validated for use with primary school teachers in Australian primary schools [8,14]. Participants were interviewed at Periods 3 and 4, to help gauge the usefulness of the workshops to teaching practice and to explore how teachers' perceived ISIs like science centres, and what they saw as roles for ISIs. Questions about other professional development activities were included to try to ascertain the extent of the influence of the workshops [see for example 36]. Additional contextual questions were also included to determine the positive and negative influences in teachers' environments.

Analysis

The STEBI-A has 25 items, the STEBI-B 23 items, each requiring the respondent to answer on a five point Likert scale. The STEBI (A and B) are constructed of two scales: the Personal Science Teaching Efficacy (PSTE) and Science Teaching Outcome Expectancy (STOE) which denote their relationship to Bandura's two factor theory of efficacy [6]. The items for these two scales are scattered randomly thorughout the instruments. For each instrument the PSTE and STOE scales are added, generating a score for each scale. Typically, analysis of the STEBI instruments involves factor analysis to ensure internal reliability and construct validity of the two scales. Given the small sample used, this was not possible. As an alternative, the results collected at Period 4 (STEBI A) and Period 3 (STEBI B) were analysed using Cronbach's alpha.

The STEBI A returned alphas of 0.914 for the PSTE and 0.776 for the STOE scale. Items 9 and 20 (both from the STOE scale) had a corrected item total correlation value of 0.3 and were excluded from all analyses of STEBI A [as per 33]. With these items excluded the STOE scale Cronbach's alpha was 0.814. The alpha values for the STEBI A were the same as or higher than those reported by Riggs and Enochs [34].

The STEBI B Cronbach alpha values were 0.899 (PSTE) and 0.864 (STOE), with none of the items showing a corrected item total correlation value below 0.3 so no items were excluded. The alpha values obtained were again equivalent to those given by the STEBI B developers [11], indicating the results have validity.

The PSTE and STOE scale scores were calculated for each cohort at each sample period to track any changes that may occur over time. These scores were also interpreted in conjunction with the data collected during the semi-structured interviews.

Interviews were transcribed in full and common words and themes were identified, developing a coding system allowing for responses to be categorised [12]. The coded interviews were then examined at an individual and a group level.

Results

Changes in self-efficacy (STEBI)

The results from the STEBI surveys showed that self-efficacy was increased as a result of the workshops, and this increase was observable for at least 11 months after the workshops were completed.

The ACT in-service cohort showed the greatest gains in PSTE overall, increasing their mean scale score from 39.29 at period 1 to 48.57 at period 4. The pre-service teachers increased their mean PSTE scale score from 41.88 at period 1 to 47.38 at period 4 and the NSW in-service cohort increased from 45.17 at period 1 to 49.33 at period 4.

The STOE scores showed very little variation for both in-service cohorts (NSW and ACT) throughout the study, with the difference between their first and final mean STOE scale scores showing a decrease of 0.5. The pre-service cohort showed the greatest increase in their STOE scores over the study period; although this increase was not maintained once they were out teaching in schools when their mean STOE scale score returned to the same as that recorded in Period 1. The mean values of both scales in the STEBI instruments recorded in this study are comparable to those found in other larger Australian studies with in-service [8] and pre-service teachers [28].

Interview data–change in practice?

At both interviews, participants were asked if they had attended any other form of science based professional development (PD). Of the 21 participants, only Anita had heard of and attended any science PD. Thus, for the majority of participants, these workshops remained the only PD in science they had received in one year.

At the first interview held four months after the completion of the workshops, participants were asked how much science they were teaching in school. The majority of participants indicated that they were teaching less than one hour of science per week. Some of the key reasons identified were the structure of the curriculum at the time.

Despite limited opportunities to teach science on their practicum, some of the pre-service participants identified that they had already used the workshop activities in their future lesson plans:

I've written the next [science] unit…I used the activities from your physics workshop (Kendra, pre-service)

Other pre-service participants continued to find the activities useful beyond their teacher training, using them and sharing them with colleagues once they were employed in school:

…this term we are doing weather. All the activities you gave me on the …workshop…I've shared [them] with the other teachers as well (Jaeda, pre-service)

For some in-service participants, the requirements of their job—particularly if they had moved to a more administrative role—meant they did not teach much science. However the workshops were still considered useful:

…Had I been on class, I'd have done more science. I'd have leaned fairly heavily on [the workshops] (Brian, ACT in-service).

At the second interview, conducted 11 months after completion of the workshops, three of the eight pre-service teachers were teaching more than one hour of science per week. While the amount of time spent on science stayed the same for the other participants, many reported adding more activities from the workshops into their science programs.

The greatest differences in results were observed between the in-service participant cohorts. The ACT cohort had the support of the principal, and the deputy vice-principal was a participant. Science appeared to be valued in the school. The same results were not observed in the NSW in-service cohort, who continued to cite time and a lack of resources as barriers to their science teaching. Science did not appear to be valued in the same way as in the ACT school, and none of the school leadership team participated in the workshops. The ACT in-service participants supported each other through the process, as described by Brian:

…[the workshops] gave an impetus to the seven of us who did it without which we…would be more backing off from science than turned out to be the case, given the fact that you did this with us.

Two of the NSW participants, Anita and Simone, changed schools in between periods 3 and 4. Their comments provided some insight into the environment of the participating NSW school. Anita was quite direct "it's all good, I'm not at [the former] school anymore!"

Simone believes the low status attributed to science is endemic to teachers generally:

…That's how I see this new school, it's no different to the motivation [to teach science] at [the old school], it's exactly the same…they don't see science as a big priority which is something that we have to change…that in the teaching culture, particularly in primary school…every school I have taught at in the last 20 years is exactly the same…you have to change that whole teacher mentality on it actually.

A role for science centres?

All participants agreed that there was a role for science centres within the formal education sphere; three main functions were identified. The first was as a source of information/resources and ideas. Most asked for a prescriptive kit or a book of ideas. Both Lorraine (ACT in-service) and Jaeda (pre-service) wanted more activities like the workshops, as they liked how they were explained and the equipment was easy. A frequently occurring comment from all participants was that of science centres having expert knowledge which the teachers could use to help them teach science.

The second role identified was that of a motivator. This still had a resource and ideas element attached to it, but a key defining factor was the human resource to "inspire you to do [science]" (Kerrie, ACT in-service). Brian noted that the workshops had done that for the ACT participants; they had all experienced that "'eureka' feeling".

The third and final identified role was that as a trainer or professional development provider. This was especially apparent in the comments made by the pre-service participants who felt that the workshops contributed to their training and development as teachers. Sam described the workshops as the "first actual, interactive, useful experiments that I have had as a teacher". This was supported by another pre-service participant, Kate:

Run more workshops - please! Seriously, the unis are failing to provide proper science units and we're just going to have this generation of teachers that are…just not going to teach science…If I…hadn't done the workshops that you did I doubt that I'd be teaching science.

In-service participants also supported the idea of science centres as training providers. Paula reiterated the perception of science centres as experts, stating that science centres could and should be used by Australian state and territory education departments for curriculum development and supporting resources.

Discussion and Conclusions

The results obtained in this study showed that the science teaching self-efficacy beliefs of both pre-service and in-service teachers were positively influenced by science centre style professional development workshops. The increase in self-efficacy was still apparent 11 months after the completion of the workshops. The results are comparable to those presented in a study of the impacts on science teaching self-efficacy of a 13 week science methods course in university [28].

For four, one hour workshops to achieve the same increases in science teaching self-efficacy as a 13 week university course, this indicates that the efficiency of short term professional development—especially that provided by ISIs—should not be dismissed. This is supported by Desimone *et al.* who did not find any significant relationship between the duration of professional development undertaken by teachers and the subsequent learning outcomes of their students [10]. Perera similarly found that a one day workshop using constructivist principles, like those employed in these workshops, were capable of facilitating teachers' conceptual change [30].

The ACT in-service cohort showed the greatest gain in PSTE overall, followed by the pre-service and then NSW in-service cohorts. The main difference between the pre-service and in-service cohorts was seen in the STOE scale. The in-service cohorts showed very little change throughout the study period, whereas the pre-service cohort showed consistent gains until they were out teaching in schools when their mean STOE score dropped back to its original level. This could be attributed to their realisation of what they could actually achieve once they were out teaching in classrooms, as opposed to the first three sample periods when their outcome expectancy was largely based on assumptions.

The ACT in-service cohort showed greater gains in their science teaching self-efficacy in comparison to the NSW in-service cohort. The ACT cohort was supportive of science and each other, as shown through their interviews. This collegial support was important in sustaining their increased self efficacy, a conclusion supported by the similar findings of Penlington [29]. The comments of some of the NSW participants indicated that the low status afforded to science as a subject area, and of teachers' reluctance to teach science, is common in many schools. This indicates a need for reform efforts to target attitudes of teachers.

Constructivist approaches can facilitate conceptual change [30]. This is required as "unless there is total commitment of all staff to new ways of working, reform efforts soon falter" [35:p12]. This too highlights the importance of examining the context of teachers' beliefs, as the context may have greater influence than other demographic variables [40,21,23]. The school environment may be the greatest limiting factor to science education reform.

The participants perceived science centres, and other ISIs, as experts in their field. This is supported in the literature [12], and echoes the use of 'outside experts' as preferred providers of professional development [4]. The participants of this study believed that science centres are capable of providing resources, motivation and training to teachers. The results of this study show science centres can indeed be effective trainers and PD providers. Even with a short investment of time and resources, these positive impacts can be maintained for at least 11 months, particularly when they occur within a school environment that is supportive of science. These results show that science centres, and other ISIs could help enhance science education as they are capable of engaging and motivating reluctant science teachers. This is a valuable finding for an area of research that has little documented evidence of impact in teacher PD [3]. It also signifies a potential way forward to achieve science education reform.

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Discussion on the Social Role of Science and Technology Museum

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Abstract. At present, public demand for science popularization is getting higher and higher. As an important national science popularization infrastructure, Science and technology museum are facing unprecedented opportunities and challenges. To meet the requirements of the times, continuously strive to raise the standards of our works, and achieve sustainable development, we must accurately locate their social role.

Firstly, this paper analyses the goals, features and functions of Science and technology museum. Then , this paper turns to explore the social role of Science and technology museum. In general, Science and technology museum should be located multiple roles.

Keywords: Science and technology museum, Science popularization, Social role

Introduction

With the social progress, public demand for science popularization is getting higher and higher. Science popularization has turned into a demand for adapting to the modern society and promoting life quality for public, as well as an important foundation of improving the scientific literacy. Science and technology museum are a kind of public-benefit facility serving for the members of the society. At the same time, they are an important platform to advocate scientific approaches, propagate scientific ideas, promote scientific spirit and disseminate scientific knowledge.

Since 1980s, Science and technology museum in China, not only the quantity, but also the scale of construction, have been rapidly developed. However, some new problems have appeared. For example, many museums lack of characteristic, their educational content and style are drab, the management is not enough reasonable, and so on. We can’t just seek expansion of the scale, and we should make more positive change, improve the education level and develop our own characteristics, so as to meet the requirements of the times and achieve sustainable development.

The Goals, Features and Functions of Science and Technology Museum

o locate the social role of Science and technology museum, we should understand the goals, features and functions of Science and technology museum firstly. Then on this basis, the model and opinion can be presented.

The goals of science and technology museum

As an informal educational institution, Science and technology museum disseminate scientific and technical knowledge to the public by various activities. Far more important, they promote the public to understand science and technology, learn scientific and technical methods, share scientific spirit and improve the scientific literacy during this process.

The features of science and technology museum

Science and technology museum are a social cultural and educational institution, and they obviously different from other educational institutions.

Firstly, they are open. This openness reveals in every way. For example, their educational objects are all social members, their demonstrations are multidisciplinary and multifactor, and their educational patterns is flexible.

Secondly, they are participatory. The public can actively get involved, and develop their knowledge structures in the course of participating. Science and technology museum put emphasis on subjectivity of the public. They are public-oriented and strive to meet the public’s needs.

Thirdly, Science and technology museum are situational. Their essence is that they build an explorations and discovery atmosphere for the public by simulating.

Fourthly, though the education of Science and technology museum is an informal education, it is intentional or planned. It has advanced educational notion, rich educational resources, and comprehensive and multi-layered educational activities.

Finally, they are scientific and interesting. Science and technology museum put emphasis on scientificity because they aim at propagating scientific knowledge and transmitting scientific information. At the same time, to gain the interest and attention of the public, keeping their interesting in education is also essential.

The functions of science and technology museum

Science and technology museum have three basic functions, some are similar to the functions of other science popularization educational institutions, but others are unique.

The first is educational function. This is the primary functions of Science and technology museum. Through such exhibitions as permanent exhibition, thematic exhibition and short-term exhibition, and diversified educational activities (for example, scientific experiments and science popularization lectures), Science and technology museum could reveal the secrets in science, develop the interest of the public in science, explore scientific methods and promote scientific spirit.

The second is service function. It provides a service for implementation of education function and development of Science and technology museum. This includes: providing information and resources about science popularization exhibition, holding training and academic exchanges for schools and other educational institutions.

The third is support function. It is used as a support for Science and technology museum to evaluate their educational function, service function and operation administration, resources development for exhibition and education, as well as deeply study for information and theory about Science and technology museum [1], so that the educational content can be more substantial and keep up with the new times.

The Social Role of Science and Technology Museum

"Care for people, service society" is the starting point and foothold for museums to implement various work. The social function and the own characterized advantages assumed by museums determine that there is no shirking the responsibility for museums to be the indispensable link and multiple roles in the current society. According to the educational function, Science and technology museum should be the disseminator of scientific knowledge, the guide of scientific

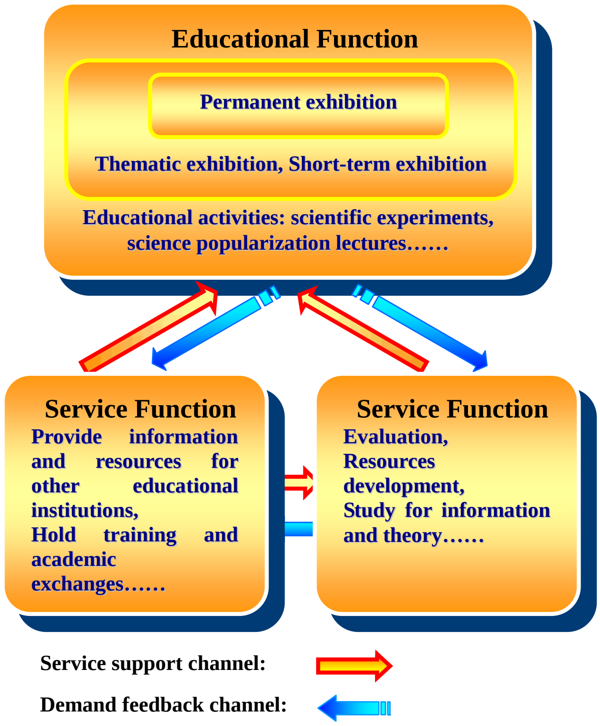

Figure 1. Functions of science and technology museum

interests and scientific concepts and the communicator between the public and the scientists. According to the service function, they should be the partner and supporter of other educational institutions. And according to the support function, they should also be the researcher on education and related theories of Science and technology museum and the collector and the performer of the historical collections.

The disseminator of scientific knowledge

It is one of the basic functions of Science and technology museum to popularize scientific knowledge and it can also absorb a wider range of educate without the limitation of age, education background and careers in order to provide fairer education opportunities for the backwards areas and the vulnerable groups [2]. Therefore, Science and technology museum have naturally become the disseminator of scientific knowledge and the lifelong classroom for the public. Certainly, the way in which museums disseminate scientific knowledge is quite different from the past museums and other education systems in the education hierarchy. It creates a fascinating learn situation and practice place in various advanced ways and methods.

Through displaying the scientific exhibits and the rich and colorful educational activities, it attracts the audience to participate in and makes them deepen their knowledge on the exhibits in an unstrained atmosphere in order to enter into the process of exploring and discovering the science.

The guide of scientific interests and scientific concepts

Currently, the target of education has been shifted from the single target of knowledge to 3D targets of "knowledge and skill", "process and method" and "emotion, attitude and value". Among the 3D targets, emotion, attitude and skill are the principal targets of education [3]. Therefore, the principal target of Science and technology museum is to promote the scientific spirits, to develop the scientific interests and to make the public establish the scientific world outlook, outlook on life, value and outlook on science and technology. Science and technology museum shall keep pace with the times and allow full play to own advantages. Through creating the learn situation and practice place, they give the public to experience science and apprehend science and stimulate the public interests of learning science; they propose that the public should continuously update scientific concepts in the keen learning atmosphere to develop scientific thoughts and scientific spirits and improve comprehensive quality. Therefore, on the basis of keeping enriching the connotation of exhibits, Science and technology museum can launch a series of activities of "scientific circus" and "scientific lab" to provide the public with precious opportunities to experience the funs and marvels of science, to anneal the ways and techniques of research and to know the scientific spirits of humanities and anecdotes in order to improve their interests and understanding of knowledge and master scientific methods and ideas.

The communicator between the public and the scientists

In the real society, education must be closely related to the social cultural activities and the practical life, so it gives more emphasis on the ability of the public to deal with the practical problems and to participate in the public affairs with scientific knowledge, which gives full play to the "scientific civil rights" of the public [4]. In the recent years, in order to set up the communicative bridge between science and technology and the society, and the scientific and technological workers and the public, as well as to develop the public sense of participation in science and technology and sense of responsibility of scientific and technological society, Science and technology museum have made constant efforts and trials to launch various communication activities on scientific and technological cultures in close cooperation with the social circles in order to make the public experience the charms of science and the elegance of the scientists at short range. For example, China Science and Technology Museum has held the activities of "I share my views on future with scientists", which is an activity the national teenagers participated in to share views on future with the famous scientists, "'Science and China' academician forum on 'Science Lecture' in China Science and Technology Museum", "Expert Volunteers" and so on. There have been many scientists flourishing on the stage of science popularizing in the museum. These activities not only promote the communication dialogues between the scientists and the public but also motivate the public to understand science, and also make museums the scientific and cultural activity center to the public and the platform to disseminate and communicate scientific cultures.

The partner and supporter of other educational institutions

Lengrand presented the educational thought of lifelong learning, which combines social education with school education and regular education with informal education tightly. As the social education place and informal education institution, Science and technology museum have formed an effective supplement and extension to schools and other educational institutions in many aspects of education aim, education objects, education content and education methods with their particular characteristics; Science and technology museum have accumulated many interesting medium and large scale scientific education appliances, so these scientific education resources and such scientific education place entitle students to feel and experience what the classroom teaching can not substitute. Meanwhile, Science and technology museum launch rich and colorful education activities through close cooperation with schools and thus they provide many kinds of service and supports for schools. For example, China Science and Technology Museum opens to the student group for free and provides an extracurricular activity place for schools; at the same time, it keeps strengthening contact and cooperation with middle and primary schools to launch “Jin Peng Lecture”, “the Future Engineers” and a series of branded activities aiming at students in order to make students deepen their understanding and comprehension to science while participating and experiencing. Besides, it holds special training classes on scientific experiments for the science teachers in schools, which gives the teachers an opportunity to promote teaching level and broaden teaching thinking. Through various measures, teachers, students and Science and technology museum have established a close contact, and also Science and technology museum have become the base to assist schools and other regular educational institutions to reach education targets and train innovative talents.

The researcher on education and related theories of science and technology museum

Science and technology museum are not only the practitioner of science popularization education, but the researcher of education teaching. Developing academic researches and exploring the law of development, exhibition education theory, designing methods of exhibitions and exhibits and management system and mechanism of Science and technology museum, is helpful to establish the correct exhibition education theory and beneficial to develop Science and technology museum. Detailed and in-depth researches can continuously promote the level of Science and technology museum, support our high-level exhibition educational activities and timely reflect the latest research achievements in the exhibition education activities to make up the gap between educational theory and educational practice and improve effects of science popularization education. Up to now, China Science and Technology Museum has made and is making dozens of research topics, such as “National 863 Planning Topic”, “Study on Worksheet Development Based on Science and Technology Museum Resources”, and “Research on Engineering Education Based on Science and Technology Museum Resources”. Some of them have made great achievements.

The collector and performer of the historical collections

Science and technology museum are not only the accumulative treasury embodying the national and ethnological scientific and technological cultures, but also the main front inheriting the history of scientific culture. It has been pointed out in the *Construction Standard of Science and Technology Museum* made by the UNESCO that one of the three types of exhibits in Science and technology museum are historical collections (the originals and the replicas):”items related to developments of science and technology from ancient times to present and items collected and reserved for displaying the progress of science and technology home and abroad.” London Science Museum, National Air and Space Museum and many overseas reputable science museums all possess abundant of treasures which are strongly attractive to a great number of audiences. But in China, Science and technology museum do not have the function of collection. Therefore, this aspect shall be strengthened by collecting and displaying some precious historical collections, exploring the connotation of scientific culture behind and performing in various ways in order to coordinate exhibition and education and other purposes. In 2004, the Nation approved of giving the spacecraft Shenzhou 1 to China Science and Technology Museum for permanent collection, which is expected to be the moment for the national museum to expand the area of collection research in order to shorten the gap of scientific and industrial museums between our nation and the developed nations [5].

Conclusion

The social role of Science and technology museum shall be rich, active and developing. That what this paper illustrates are not all for it, and these social roles should be combined together or stressed on particular emphasis because of the demands of practical work of Science and technology museum. We must keep on researching, exploring and practising in order to be adapted to the demands of social developments and to better give play to its roles.

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Mobile Technology Application in Science and Technology Museum

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Abstract. Information technology innovation enriches public communication methods of science and technology. This has been verified by inventions of personal computer, Internet and Web 2.0 in the past. Mobile technology has been used in more and more areas and it makes location-based information services by different mobile devices possible. This article investigates the opportunities and challenges for science and technology museum brought by mobile technology. It discusses typical scenarios from public visitors' and museum management's view. Examples of China Science and Technology Museum are also shown.

Science Center is a Major Player in Science Communication in Industrialized Countries Rather than Developing: Reasons and Suggestions to Bridge the Gap

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Abstract: Science centers deliver natural ways of active playful learning to their visitors and let them experience hands-on-science. They have pushed the boundaries of informal science education by telling people something starting from their daily experiences. However, the educational role of science centers in society depends on what kinds of image of science are presented by science centers to their visitors and the public, and how those images are communicated. In developing countries, Science centers are not enabled to produce desired outputs or leave a strong influence on community of interest because of their weak mission, strategic plan and corporate structure. It is still challenging for science centers in those countries to throw a personal, social, political and economic impacts on community of interest. This is important to justify their value in communicating science to all age groups.

This paper aims to provide some reasons why science centers are not so effective in developing countries while diffusing widespread knowledge of science dramatically in industrialized countries. There are also some attempts suggested to bridge this gap.

Following aspects will be pointed out in the article.

1. Publicity through media
2. Socio-cultural diversity
3. Advanced visualization technologies
4. Interesting and interactive online activities on science center's website
5. Learning science by amazing science live shows, movies, events, demonstrations, workshops.

Introduction

The perfect definition for a science center is that encourage you to experiment, touch, discover and explore. Science center is a grassroots effort to engage public to increase their understanding of the nature of science and its value to society. They provide long term learning by an opportunity to explore science in a family-friendly, comfortable environment.

In this new world citizens require more scientific information. Science centers have evolved in the last two centuries to become places of representation of that knowledge. Engaging visitors in a learning experience is a fundamental objective for science centers. But, the social and economic levels of science centers in the two groups of countries, developed and developing, has created a huge difference in learning strategy due to their difference of scientific and technological infrastructure and in the popularization of science and technology.

In developed countries science centers offer rich resources for lifelong learning, providing meeting places for citizens and the research community, supporting schools, and contributing to the cultural and economic vitality of their communities. While in many developed countries, science centers does not have enough resources to elaborate themselves because of financial problems, lack of public interest, less popularization of science, etc. There are some ways to bridge the gap of wide-ranging personal, social and economic impacts of science centers between both groups of countries.

Difference in following aspects of science centers between developed and developing countries

Publicity through media

In industrialized country for example United States, Every person is greatly aware of science center, their objectives, and benefits by participating in their programs and their value in this science and technology era. The reason for this awareness is number of hands-on-science centers in America which is above 100. Publicity of those science centers through media is the biggest reason behind their success story. They are easily accessible in each city so, public doesn't need to make a plan to go out or spend money on travelling. Every part of media as Newspaper, magazines, internet website, television, radio and advertising banners are deeply involved in helping people attracted to them.

There was an exhibition 'Mummies of the World', assembled in California science center was among the highest-ranked paid exhibits ever hosted by the Science Center. In its first 50 days, the exhibition welcomed 100,000 visitors. This could be the biggest example for the evidence of public attraction by publicity.

What happens in developing countries? There are 13 countries in South America but there is only one hands on science center among 13 countries which is in Argentina or one or two science museums. People in remote areas never visit science centers and disconnected to science and technology. They often have no interest in visiting the science center, either because of economic difficulties or because they do not feel a clear connection between science and their daily lives. We must make a special effort to carry relevant messages directly to these populations.

In order to create strong public value, science centers must be able to relate to their communities and understand their realities. They need to cultivate the ability to attract diverse audiences or bring relevant programming directly into communities. In this way, centers can empower individuals to participate actively in learning, knowledge, and innovation processes. For example, In Maloka Cycle Science program, performed on cycles due to no road or land access. Maloka's bicycles carry hands-on activities and are fitted with posters that contain information on science and technology [4]. The public can learn about a diverse range of topics and make close connections between science, technology, and their everyday lives. Activities are designed to answer questions about exercising, such as: Why do I sweat? What do I need to eat to be healthy? How do skaters perform their maneuvers without falling down? For that, skaters were invited to do demonstrations and created hands-on activities that explained the physics of their movements. On an average Sunday, they engage 500 people in activities, and more than 10,000 people can see a different face of Maloka in the streets.

The popularization of science helps to enhance personal satisfaction, self-esteem in the population. Scientific journalists and communicators play a major role in increasing public awareness of science. It was observed that governments, international organizations and relevant professional institutions should enhance or develop programs for their training. National authorities and funding institutions should promote the role of science museums and centers as important elements in public education in science.

Socio-cultural diversity

There are significant social and economic differences between developed and developing countries. Many of the underlying causes of these differences are rooted in the long history of development of such nations and include social, cultural and economic variables, historical and political elements, international relations, geographical factors.

Being born into a racial majority group with high levels of economic and social resources—or into a group that has historically been marginalized with low levels of economic and social resources—results in very different lived experiences that include unequal learning opportunities, challenges, and potential risks for learning and development.

"The Learning Sciences have not yet adequately addressed the ways that culture is integral to learning. By "culture," we mean the constellations of practices historically developed and dynamically shaped by communities in order to accomplish the purposes they value, including the tools they use, the social networks with which they are connected, the ways they organize joint activity, the discourses they use and value (i.e., specific ways of conceptualizing, representing, evaluating and engaging with the world). and other front line educators should actively integrate into science learning experiences, questions, everyday language, ideas, concerns, world views, and histories, both their own and those of diverse learners.

Advanced visualization technologies

Children enjoy active and informal learning rather than a class room education. Science Centers offer challenging exhibits that enable their visitors to experience hands-on science by actively manipulating the experiments, thus delivering natural ways of active playful learning. Science centers provide perfect educative environment to children as well as adults.

Developed countries have been successful by using the power of advancement in stimulating interest and increase understanding of the sciences. Advanced visualization technologies are often used to enrich enjoyment, inspiration and creativity in public. Science Centers in developed countries brings together experts in science education, computer science and pedagogical evaluators in order to support science education. Science movies put you in the center of the action by projecting breathtaking quality images.

In 2003 "*The California Science Center* hosted OCEANFEST 2003, a fun film-going event that gave people an opportunity to learn about, experience and truly become part of the ocean habitat and its ecosystem that we all depend on across the world. The film festival had giant-screen documentaries that captured the thrill of ocean exploration, revealed the astounding diversity of life beneath the sea and sparked a deeper appreciation of how the ocean affects all of planet earth.

In movies, Coral Reef Adventure **and** *Volcanoes of the Deep Sea*, as well as the always popular hits *Dolphins* and *The Living Sea*, the public got a chance to dive into the latest scientific knowledge about the sea that truly brought science to life with an unforgettable view and eye-popping underwater scenery. Combining great storytelling and innovative photography, these films not only have a sense of adventure but create an emotional impact that can bring people closer to nature than they ever imagined. They were one of the most technically advanced underwater films.

Many developing countries are emerging with advanced science technologies but still they have a long way to go. Developing countries should be committed to retaining high-level scientists, stimulating them, and providing funds and other support to encourage and maintain their productivity. Therefore, enhancing chances to get good quality of work and growth of social and economic levels. Further to make education enriched with advanced techniques and comparable to the quality of science in developed countries.

Interesting and interactive online activities on science center's website

Online Activities are an extension of the great fun and educational experiences of the world of science without leaving home.

In industrialized countries everyone does have access to internet. That way, they have more chances to learn science. In their websites, they choose topics related to everyday life and make it easy to understand by videos therefore, become a part of our store of long-term memories.

The basic knowledge about all scientific areas that everyone should have, is now accessible through internet. For example, http://www.cosi.org/visitors/online-activities/. This site has free videos for open heart surgery, knee surgery, how a farm is maintained, road rules and regulations etc. These online interactions have always been successful to create interest in students, increase their creativity, help them in augmenting their natural exploratory skills, innovative thoughts and make them choose a better career they like.

Science centers offer online interactive science quizzes for both kids and adults. Like, http://www.explorit.org/science.html. It has quizzes around all areas of science such as, astronomy, space, biology, chemistry, physics, weather, water, medical and math. Moreover, they have online challenges, stumpers on many topics, human body experiments like Bones and Muscles; Heart and Circulatory System; Senses and Nervous System; Lungs and Respiratory System; Digestive System; Immune System.

In many developing countries, there is rare access to internet due to lack of science and technology development or economic problems. The social and economic growth of the developed countries is dependent on an essential emphasis on education, science, and technology. The basic problems of developing countries are the weak educational and scientific infrastructure, and a lack of appreciation of the importance of science as an essential ingredient of economical and social development.

Science and technology have been given neither the urgency nor the priority they deserve in international aid. The solution is to focus on expanding the use of new sciences and technology in developing countries. With support from rich countries investments must be made in areas of particular interest to developing countries, such as education, research and technology. National policies should emphasize on all the supports for popularization of science as internet which is indispensable technology for public awareness towards science.

Learning science by amazing science live shows, movies, events, demonstrations, workshops

Awareness for science is on higher level in industrialized countries, and public know that the investment in science sector is coming back with a huge benefit in the form of bright future of children and growth of technology which is basic requirement for the social and economic growth of each country. Government and big industrialist or investors are always ready to finance for science centers. This money is used to make learning more meaningful and more understandable by using new techniques. Qualified persons are hired for science demonstrations, events and shows. High level scientist conduct exciting educational programs and presentations on a variety of hair-raising, mind-boggling, and eye-catching topics such as the human body, music, space and more. Live, interactive stage shows bring science to life!

Science Center presenters demonstrate the wonders of scientific phenomena from the stage and invite audiences to ask questions and help with the presentation. Numerous studies of visitor's conversations during or immediately after science center visits have shown evidence of visitors extending and enriching their conceptual understanding.

Some science centers provide inquiry based learning that help students achieve standards-driven understanding by expressing their natural curiosity as they pursue personal questions to explain how the world works. Research suggests that this approach enhances meaningful understanding of science content and also helps create a passion for life long learning. The Inquiry approach holds great promise for significantly improving student performance because it helps students to become active and sometimes passionate learners. Students develop a deeper understanding of the world around them and are encouraged to communicate and discuss their knowledge.

Live Science Shows present science to the public with all the grandeur of tricks, theatrics, and wonder that are sure to enlighten and entertain people of all ages. Science is about doing – seeing concepts unveil themselves right in front of you.

Figure 6. Electrifying show

Like- In Detroit science center an electrifying experience is enough to prove the learning importance in science centers that make your hair literally stand on end. Their "spark-tacular" performances demonstrate how electricity affects the world, and how electricity and magnetism interact with matter. Thousands of volts are generated during every demonstration. The whole space is built within a Faraday cage, which keeps electromagnetic waves under control and ensures the safety of other activities throughout the Science Center.

In California science center '*Mummies of the World'*, live show was organized. It had collection of both accidental and intentionally preserved mummies. The collection included ancient mummies and important artifacts from Asia, Oceania, South America and Europe as well as ancient Egypt, dating as far back as 6,500 years. The exhibit revealed how the scientific study of mummies provides a window into the lives of ancient peoples from every region of the world.

Figure 8. A mummy showed in the show

Figure 9. A mummy showed in the show

Figure 10. A mummy showed in the show

In developing countries, Public really does not seem interested to visit science centers because they do not know the benefits of informal learning rather believe in classroom education, besides they have no timely access to programs or events go on in science centers. The reason is because of no publicity, no internet access. Further more, in some countries, there is none of science centers and other have too less in number, or too far from other cities which does not have them. Therefore, transportation problem, expenses on travel diminishes the excitement and curiosity to visit science centers.

In those areas school field trips to science centers should be organized. Teachers should encourage students to participate and interact to science activities offered by science centers. Teachers are ideal for students, they should use their belief on them and direct in gaining skills and developing positive attitudes toward the subject matter. They should help students in acquiring enthusiasm, exploration and new conceptual understanding considerably faster than they could in the classroom.

There should be some government programs under which poor students do not have to pay the fees; some scholarships should be awarded to children for participating and showing their creativity. These are some ways to encourage children in achieving better goals in life and joining the new world of science and technology reaching to high levels in developed countries.

Conclusion

In summary, science centers have proved themselves as an essential part of informal learning for students or adults. Developing countries need to do better in educating people in science and technology via fulfilling some basic demands of popularization of science centers.

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Role of Media in Effective Communication for Energy Conservation: A Case Study of Guwahati City

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Abstract. This paper is aimed to review communication activities of the energy producers and suppliers of Assam for energy conservation. The study also tries to find out the consumers or energy users perception on energy conservation, their media habits. The report aims to discuss that most suitable media for energy conservation, which have maximum reach and impact to make aware and conscious the energy consumers and enhance their energy conservation habits. The paper is presented on the basis of all the data collected through interviews with the selected respondents of Guwahati city and officials of government of Assam agencies related to energy production, supply and conservation.

Keywords: Energy conservation, Awareness, Communication, Media habits, Conservation habit

Introduction

Energy conservation refers to actively reducing the amount of energy used, or making sure it is used as efficiently as possible. Energy means the ability to do something like warming something, moving something and lighting something. Energy conservation is meant to reduce the amount of energy being used. Energy conservation can be achieved through efficient energy use, in which case energy use is decreased while achieving a similar outcome, or reduction in the amount of energy consumed in a process or system or by an organization or society, through economy, elimination of waste and rational use.

Energy conservation has emerging as major issue in the country as the demand is increasing in a very rapid rate, which is also expected to be more than double 2030. There is a continuous gap between demand and supply of energy. Conservation and efficient utilization of energy of resources play a vital role in narrowing the gap between demand and supply of energy. Energy conservation also helps to save precious fossil fuel like coal, gas, oil which is used by the generating organization to generate electricity. Also reduction of use of fossil fuel leads to reduction of emission of harmful to gasses into the atmosphere.

While using energy, a considerable amount of energy is wasted. Therefore, conservation is an extreme necessity in present time reduce wastage and consumption which is possible only making aware and conscious the energy users or consumers. The use of communication strategies and techniques in order to disseminate methods and ways of energy conservation and convince people to adopt an energy saving behaviour has been recognized significantly.

To encourage and promote the efficient use energy, the Government of India (GOI) has enacted the Energy Conservation Act 2001 ('EC Act') and has established the Bureau of Energy Efficiency (BEE) in the Ministry of Power as the Nodal Central Government agency responsible for spearheading the improvement of energy efficiency through a combination of regulatory and promotional programmes. The Act recognizes the need for a strong and vigorous decentralized approach at the state level and provides for the establishment of state energy conservation agencies to plan and execute these programmes. It is a long and arduous strategic task to keep promoting energy conservation in the course of the country's economic and social development.

What is Energy Conservation

"Energy conservation" can mean a variety of things; the most common meanings are:

- using less energy in a particular application
- finding the ways to purchase particular forms of energy at lower cost. This is usually accomplished by negotiating with energy providers or by using energy under less costly conditions.
- shifting to different energy sources of lower price
- using "free" or "renewable" energy sources
- conserving water and materials, as well as energy sources. (Donald R. Wulfinghoff)

Why Conservation Energy Requires

- People uses energy faster than it can be produced. Coal, oil and natural gas - the most utilized sources take thousands of years for formation.
- Energy resources are limited. India has approximately 1% of world's energy resources but it has 16% of world population.
- Most of the energy sources cannot be reused and renewed. Non renewable energy sources constitute 80% of the fuel use. It is said that the energy resources may last only for another 40 years or so.
- The citizen save the country a lot of money when they save energy. About 75 percent of the country's crude oil needs are met from imports which would cost about Rs 1,50,000 crores a year.
- Energy saved is energy generated. When a person saves one unit of energy, it is equivalent to 2 units of energy produced
- Saving energy may reduce pollution. Energy production and use account to large proportion of air pollution and more than 83 percent of greenhouse gas emissions
- It is a duty to conserve today for tomorrow's use. An old Indian saying indicates "The earth, water and the air are not a gift to us from our parents but a loan from our children". (Source: Integrated Energy Policy Report2006, Planning Commission, GoI)

Power Scenario of Assam

Electricity consumption per capita in Assam is one of the lowest in the country. Assam accounted for only a small fraction i.e. 0.16 per cent of the total generation of electricity in the country during 2000-2001. On the contrary, consumption of power in the state has been increasing in the recent years. The average per capita consumption of electricity in the state was 120 Kwh in 2000-2001 and 140 Kwh in 2001-2002. (Source: ASEB)

Table 1. Sale of Electricity by Type of Consumers in Assam (In MKWP)

Type of consumption	1999-2000	2000-2001	2001-2002
Domestic	516.59	540.80	569.31
Commercial	150.63	155.84	164.06
Industrial (Total) Low& medium voltage High voltage	263.11 18.75 244.36	306.73 23.14 283.59	375.86 24.36 351.50
Public lighting	4.45	4.39	4.63
General purposes	22.95	26.89	28.32
Irrigation	10.34	9.01	9.49
Public water works	26.86	27.98	29.46
Tea garden	267.90	279.94	294.71
Bulk supply in the state	236.86	251.29	207.14
Total unit sold to ultimate consumers	1499.7	1602.87	1682.98

Source: ASEB

Assam has about 87% of the State's population living in rural areas. Out of a total number of more than 26000 villages in the State, 70% have been electrified. A large number of households in the State do not have electricity and use kerosene for lighting. Even for those areas, which are electrified, there is a tremendous shortage of power supply. Thus it is not uncommon for these areas to have 10 – 15 hours of blackouts and brownouts every day. As per 2001 census 87.09% of the total population of Assam live in 26,247 villages. As on March 31, 2006, 21,586 villages have been electrified through conventional grid by Assam State Electricity Board (ASEB). Thus the percentage of total villages electrified so far is about 82%. However, only 16.54% of the total households in these electrified villages have electricity connection. Thus while 83.46% of households in the already electrified 21,586 villages is still deprived of electricity, 4661 villages are still to see the light of electricity. (Source: ASEB)

The Study

Communication plays a central role in shaping people's understanding of the natural world and the role of humans therein. Such understandings, in turn, influence the way they act and their support for, or opposition to, specific policies. The media is a central arena for amplifying energy conservation issues and can influence the course of policy and the common masses.

The study is to explore the role of media in energy conservation especially in Guwahati city. Energy is more than just a commodity. It's a privilege. Most of the people don't realize that majority of the energy they use comes from non-renewable sources which consistently pollute air and water; in doing so they pollute themselves. With that being said, there are ways in which they can contribute personally to energy conservation and a more eco-friendly society. Some of the most convenient ways to conserve energy include: turning off lights when not in use, replacing traditional light bulbs with fluorescent ones, turning off power supply/unplugging electronics not being used, and regularly replacing home air conditioning filters etc. Energy conservation is not a one person job. However, just one person doing their part has potential to influence big change. Every person of the society has a duty to do their parts: as individuals and as a community to influence local and government change thus offering great hope for a healthier future.

Objectives of the Study

1. To comprehend the types of stakeholders should be involved in the communication process.
2. To analyze and the desired change in behavior.
3. To identify the constraints in communication with the citizen
4. To study which media of communication would be most effective for energy conservation
5. How will the communication process be monitored and evaluated?

Methodology

The present study was conducted by using mixed approach, combining quantitative information with the qualitative research methodologies. Structured interviews were conducted with the randomly selected household in 15 wards under the Guwahati Municipal Corporation area. Listing and review of existing IEC material were done in terms of media and messages used distribution/delivery, responsibilities and modalities of preparing the material etc. The field survey was conducted in September-October 2010.

Description of the Study Area

Guwahati is the largest city in the North-Eastern Region which is among the first 100 fastest growing city of the world and 5th fastest growing among Indian cities. Guwahati is recognized to be the most critical city in the Northeast India. The city has a well-developed connectivity with the rest of the country and acts as the gateway to the entire North Eastern India. Hence, the development of the city is not only critical to the state of Assam but also to the entire Northeast. It is the largest commercial, industrial and educational center of the N-E region. Given the criticality of the city to the entire region, it is quite evident that population of the city would continue to grow rapidly in the future. The total population covered under the Guwahati Metropolitan Area as per 2001 census is 8,90,773.

Limitations

Like many other research works and techniques, this study also have got some inherent limitations although not affecting much to the final output to any significant level.

Some of the limitations are:-

- Media role in communicating for energy conservation being a vast area of study, within a shorter time all issues related to this are not possible to investigate, however maximum care has been taken to cover most of the important issues.
- The survey restricted among the household consumers and vehicle users; not the industrial sectors, builders and other sectors.

Selection of Respondents and Sample Covered

(i) **Selection of government officials**: The concerned official from the headquarter of Assam State Electricity Board (ASEB) and Assam State Designated Agency (asda) and Assam Energy Development Agency have been selected for studying their communication initiatives in energy conservation.

(ii) **Energy users/consumers:** The structured questionnaire was administered amongst 125 respondents. The survey covered 80 males and 45 females in 15 wards of Guwahati Municipal Corporation areas. Majority of the respondents belonged to the literate category, except in case which are belongs to slam areas of the city. The respondents include homemakers, government servants, businessman, labors and drivers of public vehicles. More than 50 per cent of the respondents from all wards fall into income category of above Rs. 25,000 per month. 70% respondents have possesses vehicle in their family.

Findings of the Study

- Respondents' knowledge about energy conservation is not perfect.
- Respondents in the study areas are aware about the monetary losses due to their careless uses of electricity or LPG. However they are not informed about other relevant issues like pollution or other information that most of the fuels of the country are imported. They are also less interested about the issues like climate change or harmful effect of their household appliances at Ozone layer etc.
- More than 80% of the respondents from all the study areas have mentioned about the enhanced expenditure for installation of CFL bulb.
- Most of the household head informed that he is aware about the issue, however the same are not practices by their family members at their home though he discusses on the issue with the family members.
- The drivers who are also respondents of the survey mentioned that though they are aware about the fuel losses but never calculated that how much it looses in a month or in a year. They are never approached by anybody about the precaution of burning fuels at traffic signals or at the bus stand.
- The respondents are also blame governmental agencies for not following the energy conservation norms and office employees for careless uses of lights, fans, ACs and governmental vehicles.
- The official of ASEB has mentioned that the private company offices in the city are careless about the conservation of electricity as their bills are being paid by the corporate head office out side the state.
- The hotel owners who are also selected as respondent mentioned that consciousness is important among the general people as everything can't be controlled by enacting laws. They mentioned that most of the customers keep on the switches lights, fans, ACs etc. when that are not in use.
- The respondents (35%) mentioned about the high cost of the equipments uses in production of energy from renewable sources and poor after sales services for maintenances
- The majority of the respondents (60%) express their willingness to know more about the technology being utilized in production of energy from the renewable energy sources.
- On government initiatives, majority of the respondents mentioned that government action didn't touches the common masses; their activities restricted in organizing seminars at star hotels, competition in the aristocrat schools, clubs etc. Most of the literatures are in English, which are also information giving rather then persuasive.
- Respondents also stress upon the involvements of Non Governmental Organisations and renowned persons who can endorse messages to attract the common masses.

Media habits

- In most of the study areas relatives and friends are the major sources about energy conservation
- Majority of the respondents can't recall any advertisement or any notice which is appeared in any print or electronic media. Instead they prefer to know more on the subject from the media. They accused print and electronic media for ignoring the very sensitive issues though they pumped some other issues which are not relevant to them.
- As regard source preference for obtaining on energy conservation the largest portions of the respondents mentioned about TV and community meeting. Few respondents also preferred hand bill/pamphlets/ booklets. Help lines were also mentioned some of the respondents.
- Some of the respondents (20%) mentioned about the Electricity meter reader, who may be

trained to impart tips and techniques on electricity saving methods to the customer at their home.
- In the study areas, majority of the respondents listen to radio programme for less than one hour a day.
- The survey reveals that most of the respondents agreed to participate in the energy conservation campaign.

Discussion

The process of social change starts with a stimulus which may from outside or from the within of a particular society. Media can generate that initiative on the energy conservation issue in the society informing shortage of electricity, finite sources of petroleum product, environmental pollution due to burning of fossil fuel etc. However it is extremely important that before launching any media activity the target audience have to be studied thoroughly.

Using mass media can be counterproductive if the channels used are not audience-appropriate, or if the message being delivered is too emotional, fear arousing, or controversial. Undesirable side effects usually can be avoided through proper formative research, knowledge of the audience, experience in linking media channels to audiences, and message testing. The finding of the survey reveals different choices of media. The study shows that better results or outcomes could be achieved with a combination of participatory media along with the other electronic and print media. After interacting with the respondents it is presumed that following media will be more effective for awareness campaign for energy conservation.

***Poster*:** Posters can be designed to be both eye-catching and convey information. It is a visual which has to catch the attention of the audience and pass on to them a simple message at a glance. This medium may be useful to remind the tips and techniques of energy conservation.

***Flash card*:** A flashcard is a set of cards bearing information, as words or numbers, on either or both sides, used in classroom drills or in private study. One writes a question on a card and an answer overleaf. Flashcards can bear vocabulary, historical dates, formulas or any subject matter that can be learned via a question and answer format. Each card is 'flashed' before the audience accompanied by the verbal commentary. The electricity meter reader can use this medium to covey a message of electricity conservation.

***Bulletin board*:** A bulletin board can be utilized for display of news sheets, announcements, booklets, bulletins, circular letters, newspaper cutting etc. The board may be hanged at city bus stoppages, bus terminal, railway station, airport, shopping mall etc.

***Exhibition*:** This medium is very useful to demonstration of various equipment of production of energy from the renewable energy sources. By seeing people may attract to use the equipment new machines.

***Hoarding*:** Hoarding is another good medium to catch public attention. The medium is useful for any product or service at the introductory stage or repeating something for permanent behaviour change. Hoarding normally placed at busy areas where 'opportunity to see' is more.

***Street play*:** Street play is one of the effective medium to highlight on any current issues like shortage of electricity, finite sources of fuel, rising demand of energy etc.

***Folk songs and folk dances*:** There is really no such genre as folk dancing. Rather, there is a large body of unrelated non-classical dance forms. The only thing common among these dance forms is they are rural origins. This is a good medium for the people of slam areas of the city.

***Meeting*:** Meeting is one of the important tools of communication. Meeting may be organized in every wards of the city. The citizen gets opportunity to ask questions during the interaction period with the resources persons.

***Radio*:** Among the electronic media FM Radio is the popular medium in Guwahati city. The medium may be used to provide tips of energy saving in a regular interval.

***Television*:** Television is also one of the popular medium in the surveyed villages. However the villagers watch TV mostly on entertainment purposes rather then as a medium of education or information. The medium have high potentials in creating awareness on energy conservation.

***Newspaper*:** Newspaper is also a powerful medium creating awareness for energy conservation through the information providers or the extension workers. The vernacular newspapers are more useful in this regard.

Conclusion

With this limited investigation, it may conclude that media can be catalyst promotion of energy conservation and creation an energy conservation habits among the common masses. However it is important that media should carry the need based information applicable to the consumers' day-to-day life. It is also important that the message should be designed as per the receivers' education and fit with their local culture. Media is a good tool for this distribution and sharing of knowledge of tips and techniques for energy conservation which stimulate for growth and development of the energy sectors of the state/country. Media may empowers people to take rational and informed decisions through appropriate knowledge; inculcates necessary skills and optimism; facilitates, stimulates pertinent action through changed mindsets, modified behaviour and reinforces the same.

The government agencies should design and deliver participatory public communication campaign approach which should raise awareness and ease communication barriers among the agencies, institutions, governments departments, NGO/CBOs involved in public awareness campaigns capacity-building efforts in the state.

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A Comparative Study on the Frame of the Science News about Novel Swine-Origin Influenza A(H1N1)–Focused on *Chosun Ilbo* and *The Kyunghyang Shinmun*

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Abstract. This study analyzes news reports from Chosun Ilbo and The Kyunghyang about novel swine-origin influenza A(H1N1) focusing on framing. This study is designed with content analysis as the study method. One of the predominant results of this study was that Chosun Ilbo used more expert news sources than The Kyunghyang, and reported more exact science news because of that. Chosun Ilbo and The Kyunghyang also differed in main formal news frames and content news frames according to timeing.

Keywords: Content analysis, News frame, News source, Novel swine-origin influenza A(H1N1)

Introduction

As new kinds of epidemics have appeared since the late 1990s, people have increased concerns about their health. In a situation where the public can get information about a kind of epidemic from newspaper's science news, the study of science reports has become more and more important.

This study analyzes *Chosun Ilbo*'s news and *The Kyunghyang*'s news about novel swine-origin influenza A(H1N1) from April 27, 2009 to December 11, 2009.

This study focuses on the difference between sources for *Chosun Ilbo* and *The Kyunghyang*, and the difference of frames between *Chosun Ilbo* and *The Kyunghyang*.

Theoretical background

News source of science news

Because of the precise nature of science news, journalists covering science stories have to rely on scientists as news sources. Therefore, the selection of scientific experts in science reporting is important.

In a case study of reporting of the marijuana controversy, In Shepherd (1981) found that the media quoted as experts not primarily the most relevant and experienced researchers, but rather health administrators and highly prominent scientists, regardless of their specific field of expertise. From the perspective of journalists, it is not research productivity but other qualities that define a good public expert. Practitioners as well as senior scientists with overview knowledge and general experience may be better suited than the actual researchers in the subject matter to relate research to decision problems, to integrate different knowledge sources, and to provide contextualised expertise. Rothman (1990) has analysed possible biases in the selection of experts from a scientific community. He concludes from several case studies of expert controversies that journalists' selection of experts is biased: experts representing minority positions are usually overrepresented in the coverage. Kepplinger et at. (1991) argue that media tend to select expert sources that support their editorial policies. Goodell (1977) concludes that the media focus on relatively few 'visible scientists' and select scientific sources 'not for discoveries, for popularising, or for leading the scientific community, but for activities in the tumultuous world of politics and controversy'(Peters, 2008).

Frame theory

The frame of the press reconstructs the social reality of issues (Gamson & Modigliani, 1989). According to Gitlin (1980), reconstruction of the social reality of the frame is a pattern of continuous reinterpretation going through perceptions of reality, interpretation, selection, emphasis, and exclusion. Entman (1993) also pointed out reconstructive aspects by emphasizing the selectivity and salience of the frame. Iyengar and Simon (1993) said that in addition to studies of frame in psychological and social academia, many researchers tend to focus on research such as the story-line, symbolism and stereotypes which media appeared on media. Framing-events and issues affect how the news audience understands these events systematically

(Price, Tewksbury & Powers, 1995; Price, Tewksbury & Powers, 1996).

Media frames can be summarized as 'the core ideas that audiences are aware of the aspects and consist of to interpret and evaluate in the direction of the aspects presenting by screening which issues, presenting specific aspects of the issue repeatedly, and strengthening' (Yang, M. S., 2001).

Subject and method of the study

Subject of the study

The source of science articles is based on the concept of the accuracy of scientific articles (Choi, Y. H., 1990). As we analyze scientific reporting, the frame is a useful theoretical background (Kweon, S. H., 2006). To compare sources and the frame of the new flu-related science news in *Chosun Ilbo* and *The Kyunghyang Sinmun*, research questions were set as follows:

[Research Questions 1] What differences are there between the sources of *Chosun Ilbo* and the sources of *The Kyunghyang Shinmun* on the new flu-related science news?

[Research Questions 2] What differences by stage are there between the frame of *Chosun Ilbo* and the frame of *The Kyunghyang Shinmun* on the new flu-related science news?

3.2 Method of the study

In this research, the unit of analysis was the text of a news article about the new flu. 684 news articles were analyzed from April 27, 2009 to December 11, 2009. Among them, the number of *Chosun Ilbo*'s news articles was 386 and the number of *The Kyunghyang*'s news articles was 298.

Referring to WHO epidemic alarm stage and Korean new flu epidemic crisis levels, articles were separated by three major stages (<Table 1>) and analyzed.

Analysis categories have news sources and frames. In news sources, subcategories have the kind of news source and the count of new sources. In frames, Iyengar (1991) divided frames by episodic and thematic frames. Subcategories have formal news frames, new flu generation causes frames, economic results frames, public agenda-centered frames, and disaster recognition frames.

This study used quantitative content analysis. Frame analysis can be divided into the deductive approach method and the inductive approach method (Semetko & Valkenburg, 2000). In this research, using the deductive method, news frames were analyzed.

Table 1. Date and the Count by the Stage

Stages	Date	The Count of *Chosun* articles	The Count of *Kyunghyang* articles	Total
The first stage	2009.4.27 ~ 7.20	110	109	219
The middle stage	2009.7.21 ~ 11.2	213	127	340
The intensive stage	2009.11.3 ~ 12.10	61	60	121

Results of the Study

Sources of the new flu news

The analysis result of news sources of the new flu news are shown in <Table 2>. *Chosun Ilbo* used more Korean University news sources than *The Kyunghyang*, and *The Kyunghyang* used more anonymous and others, foreign media, and foreign government · administrative organizations news sources than *Chosun Ilbo*. Thus, *Chosun Ilbo* used fewer anonymous news sources and more Korean University news sources than *The Kyunghyang*. Therefore *Chosun Ilbo* used more expert news sources than *The Kyunghyang*.

Table 2. News source analysis results (plural check)

News sources	News Media		News sources	News Media	
	Chosun	*Kyunghyang*	*Chosun*	*Chosun*	*Kyunghyang*
The Korean government Administrative Organizations	289 (40.4%)	212 (35.9%)	Foreign Companies	8 (1.1%)	4 (0.7%)
Korea Universities	72 (10.1%)	23 (3.9%)	Foreign Research institutions	2 (0.3%)	0 (0%)
Domestic Companies	32 (4.5%)	19 (3.2%)	Foreign public	1 (0.1%)	0 (0%)
Domestic Research institutions	3 (0.4%)	2 (0.3%)	Foreign Researches Councils societies	0 (0%)	2 (0.3%)
Domestic public	7 (0.8%)	0 (0%)	Foreign Others	10 (1.4%)	1 (0.2%)
Domestic Researches Councils societies	6 (0.7%)	6 (1%)	International Organizations	35 (4.9%)	33 (5.6%)
Domestic Others	49 (6.9%)	27 (4.6%)	Domestic media	1 (0.1%)	1 (0.2%)
The foreign government Administrative Organizations	51 (7.1%)	66 (11.2%)	Foreign media	58 (8.1%)	75 (12.7%)
Foreign Universities	2 (0.3%)	1 (0.2%)	Anonymous and Others	89 (12.4%)	118 (20%)
Total	715 (100%)	590 (100%)	Total	715 (100%)	590 (100%)

Frames of the new flu news

Formal news frames**:** The analysis result of formal news frames are shown in <Table 3, 4>. Formal news frames had many episodic frames (48%). Both newspapers have many episodic frames, and *The Kyunghyang* has more thematic frames (43.6%) and episodic frames (51%) than *Chosun Ilbo*. In the first stage and the middle state, episodic frames were 50.7% and 50.9% respectively, and their percentages were high. In the intensive stage, the percentage of thematic frames (38%) was higher. *Chosun Ilbo* had more episodic frames than *The Kyunghyang* and *The Kyunghyang* had more thematic frames than *Chosun Ilbo* in the first stage. *The Kyunghyang* had more thematic frames and episodic frames than *Chosun Ilbo* in the middle stage and the intensive stage.

Content news frames**:** The analysis results of content news frames are shown in <Table 5>. Content news frames were public agenda-centered frames (77.9%), disaster recognition frames (68.1%), new flu generation causes frames (19.7%) and economic results frames (10.5%) in descending order. *Chosun Ilbo* had more all content news frames than *The Kyunghyang*. Content news frames had many public agenda-centered frames in all stages, had many economic results frames (11%) in the first stage and had many new flu generation causes frames (22.1%), public agenda-centered frames (85%), and disaster recognition frames (71.8%) in the middle stage.

Table 3. Formal news frames analysis results by the stage

		Stages		
		The first stage	The middle stage	The intensive stage
Formal news frames	Thematic Frames	85	109	46
		(38.8%)	(32.1%)	(38%)
	Episodic frames	111	173	43
		(50.7%)	(50.9%)	(35.5%)
	Nothing	23	58	32
		(10.3%)	(17%)	(26.5%)
Total		219	340	121
		(100%)	(100%)	(100%)

Table 4. Formal news frames analysis results by the stage and news media

		Stages					
		The first stage		The middle stage		The intensive stage	
		News media		News media		News media	
		Chosun	*Kyung-hyang*	*Chosun*	*Kyung-hyang*	*Chosun*	*Kyung-hyang*
Formal news frames	Thematic frames	38	47	56	53	17	29
		(34.5%)	(43.1%)	(26.3%)	(41.7%)	(27.9%)	(48.3%)
	Episodic frames	57	54	102	71	16	27
		(51.8%)	(49.5%)	(47.9%)	(55.9%)	(26.2%)	(45%)
	Nothing	15	8	55	3	28	4
		(13.6%)	(7.3%)	(25.8%)	(2.4%)	(45.9%)	(6.7%)
Total		110	109	213	127	61	60
		(100%)	(100%)	(100%)	(100%)	(100%)	(100%)

Table 5. Content news frames analysis results by the stage (plural check)

		Stages		
		The first stage	The middle stage	The intensive stage
Content news frames	New flu generation causes frames	41	75	19
		(18.7%)	(22.1%)	(15.7%)
	Economic results frames	24	37	11
		(11%)	(10.9%)	(9.1%)
	Public agenda-Centered frames	153	289	89
		(69.9%)	(85%)	(73.6%)
	Disaster recognition frames	138	244	81
		(63%)	(71.8%)	(66.9%)

Conclusions and Implications of the Study

Conclusions

This research focused on exploring whether there are differences in sources and frames of science news through content analysis of Korean newspapers. As a result of statistical analyses, *Chosun Ilbo* used more expert news sources than *The Kyunghyang* and reported more exact science news due to more expert news sources. Formal news frames had many episodic frames. Both newspapers had many episodic frames, and *The Kyunghyang* had more thematic frames and episodic frames than *Chosun Ilbo*. In the first stage and the middle state, the percentage of episodic frames was high. In the intensive stage, the percentage of thematic frames was higher. In the first stage, *Chosun Ilbo* had more episodic frames than *The Kyunghyang* and *The Kyunghyang* had more thematic frames than *Chosun Ilbo*. In the middle stage and the intensive stage, *The Kyunghyang* had more thematic and episodic frames than *Chosun Ilbo*. Content news frames were public agenda-centered frames, disaster recognition frames, new flu generation causes frames, and economic results frames, in descending order. *Chosun Ilbo* had more all content news frames than *The Kyunghyang*. Content news frames had many public agenda-centered frames in all stages, many economic results frames in the first stage, and many new flu generation causes frames, public agenda-centered frames and disaster recognition frames in the middle stage.

Korean newspapers should use professional scientists as more sources and decrease anonymous sources in order to cover more accurate science news.

Chosun Ilbo and *The Kyunghyang* changed in main formal news frames and content news frames according to the time period. Korean newspapers saw the same themes as a different frame according to the time period.

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Understanding the Roles of Value Predispositions, Mass Media, and Cognitive Processing in Public Attitudes toward Nanotechnology

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Abstract. This study examines how value predispositions, communication variables, and perceptions of risks and benefits are associated with public support for federal funding of nanotechnology. Our findings show that highly religious individuals were less supportive of funding of nanotech than the less religious individuals, whereas individuals who held a high deference for scientific authority were more supportive of funding of the emerging technology than those low in deference. Mass media use and elaborative processing of scientific news were positively associated with public support for funding, whereas factual scientific knowledge had no significant association with policy choices. We conclude with policy implications that will be useful for policymakers and science communication practitioners.

Keywords: Mass media; Elaborative processing; Interpersonal discussion; Risk; Nanotechnology

Introduction

Nanotechnology is projected by the federal government to be the defining technology of the twenty-first century, with the potential to drive our next industrial revolution (National Science and Technology Council 2000). According to the 2006 State of the Union Speech by President George W. Bush, nanotech is among the emerging technologies for which funding will be doubled over the next ten years in the United States. With wide applications cutting across important sectors such as medicine and healthcare, environment, and national defense, nanotech promises to overcome many of the challenges that the world faces today (National Science and Technology Council 2000). In 2007 alone, $147 billion worth of nanotech-enabled products were produced in the market and the annual global revenue of nanotech-based products is expected to reach $3.1 trillion by 2015 (Lux Research 2008). Despite this, there are fears that the novel technology could lead to various health and environmental problems, and other negative social, moral, and ethical consequences (Bainbridge 2003; Sententia 2004; PCAST 2005).

Currently, the American public is unaware of the potential risks and benefits of this emerging technology (Scheufele and Lewenstein 2005). Public opinion about nanotech is likely to have a bearing on future funding-related policies (Roco and Bainbridge 2003). Although the U.S. is currently leading the “nano race” in terms of public and private funding (European Commission 2005), this technological supremacy may be threatened if public attitudes toward nanotech were to turn negative. For example, if funding and infrastructure support for nano-scientists in the U.S. were insufficient, they may choose to relocate their research base to other countries with more attractive funding opportunities. Ensuring constant funding initiatives for nanotech will enable the U.S. to remain competitive in the international arena and to sustain a positive climate for science and technology in the country. Since the public is primarily unfamiliar with nanotech at this early stage, examining the mechanism behind how public form attitude toward support for federal funding of nanotech is pertinent.

Thus far, there are two lines of assertions that explain how the public form attitudes toward nanotech. First, the “familiarity hypothesis” asserts that public support for nanotech will likely grow as awareness or knowledge of it expands. Using meta-analyses of public opinion studies of nanotech, Satterfield et al (2009) have demonstrated that familiarity with nanotech is correlated with positive attitudes toward it, in which members of the public who claim to know a lot about nanotech were substantially more likely to believe its benefits outweigh its risks. Conversely, the predisposition argument asserts that personal values and heuristics could play a bigger part in shaping public attitudes toward nanotech. For example, individuals who hold a pro-science and technology orientation are predisposed to seek out scientific information from the mass media, to discuss science with others, which in turn, produces positive attitudes toward nanotech (Vandermoere et al. 2009).

Since these arguments are far from conclusive, this study aims to use a holistic approach to examine how both cognitive and heuristic factors can potentially shape public level of support for federal funding of nanotech. Previous research have shown that public attitudes toward emerging technologies are associated with value predispositions such as religious beliefs and deference to scientific authority, and other heuristic cues such as risk and benefit perceptions (e.g., Ho et al. 2008; Nisbet et al. 2002; Priest 2001; Priest et al. 2003). Scholars have also shown that the public often rely on positive frames and/or information in the media to form favorable attitudes toward nanotech (e.g., Brossard et al. 2009; Lee et al. 2005; Scheufele and Lewenstein 2005).

In addition, individuals' use of cognitive processing strategies to reflect upon and absorb the scientific information that they gathered from the mass media can also be associated with their acceptance of the new technology. Scientific knowledge has been demonstrated to have a small association with public acceptance of emerging technologies (e.g., Miller et al. 1997; Miller and Kimmel 2001). We will therefore examine how these factors are associated with public support for funding of nanotech in this study.

Value predispositions

Religious guidance is a likely heuristic cue in which the public will depend on to form judgments about nanotechnology. Recent research has shown that religious guidance is one of the major factors associated with public resistance to emerging science and technologies (Brossard et al. 2009; Gaskell et al. 2005; Ho et al. 2008; Nisbet 2005). This is hardly surprising given the historical intransigence and normative inconsistencies between religion and science (Brooke 1998; Miller et al. 1997). One explanation for this tension has to do with the perception that science tampers with nature or is akin to playing God, putting it at odds with religious beliefs (Sjoberg 2004; Sjoberg and Winroth 1986).

Nanotech is not spared from the potential friction between religion and science. The U.S. Food and Drug Administration officially defined nanotech as part of the Nano-Bio-Info-Cogno (NBIC) technologies that highlight the unity of nature at the nanoscale, and the intelligible processes of evolution that have constructed life and intelligence, from the nanoscale, without divine intervention (Bainbridge 2003; Sententia 2004). Bainbridge (2003) argued that this all-inclusive approach to nanotech may go against people's religious beliefs and reduce their support for the emerging technology.

Brossard et al. (2009) found a negative relationship between the strength of religious beliefs and support for funding of nanotech among the U.S. public. They concluded that people use religiosity as an attitudinal filter when it comes to forming opinions about the new technology. Religious people may lump nanotech, biotech, and stem cell research together and perceive them as means to enhance human qualities. In short, some people may believe that researchers are "playing God" when they create materials that do not occur in nature, especially where nanotech and biotech intertwine. Based on these considerations, we therefore hypothesize that religious beliefs will be negatively associated with public support for federal funding of nanotech (*Hypothesis 1*).

Deference to scientific authority is another value predisposition that can be associated with attitudes toward science and technology (Brossard and Nisbet 2007; Ho et al. 2008). Deference to scientific authority is defined as "a long-term socialized trait that guides citizens' responses to a range of technical controversies" (Brossard and Nisbet 2007, p. 10). Studies have demonstrated that the more individuals defer to scientific authority, the more likely they were to hold positive views on controversial scientific issues (e.g., Brossard and Nisbet 2007; Ho et al. 2008). The American educational system has instilled a strong sense of respect for scientists and scientific institutions among the citizens, and this has fostered a culture of deference to scientific authority in the U.S. These have been reflected in education that involved teaching people to view scientific research as solitary activities that are kept away from external social and political pressures (Bimber and Guston 1995), and to perceive science as a pure and unbiased pursuit that increases our knowledge about the world (Irwin 2001). Hence, we posit that deference for scientific authority will be positively associated with public support for federal funding of nanotech (*Hypothesis 2*).

Mass media

The mass media is the main source of information about science and technology for majority of the public (Pew Internet and American Life Project 2006), and media coverage have been shown to play an important role in shaping public attitude toward science and technology (Ho et al. 2007, 2008; Nisbet et al. 2003; Nisbet and Lewenstein 2002). In a content analysis of the *New York Times* from 2000 to 2003, Gaskell et al. (2004) found an overwhelming coverage of benefits than risks for nanotech, and concluded that “media coverage is more slanted towards a supportive culture of science and technology in the U.S.” (p. 496)

Likewise, by examining nanotech coverage in major U.S. and non-U.S. newspapers published from 1988 through 2004, Stephens (2005) found that the proportion of articles in which benefits outweighing risks (versus risks outweighing benefits) is three to one. Friedman and Egolf (2005) shown that even when health and environmental risks were covered in the U.S. newspapers, most of the articles published were balanced and described risks with both positive and negative information. The researchers concluded that news coverage in the U.S. would positively influence public opinion about nanotech (see also, Scheufele and Lewenstein 2005).

Besides this, some scholars have argued that the tone of media coverage of nanotech can serve as a simple decision rule in influencing the risks and benefits considerations among the public (Nisbet and Scheufele 2007; Scheufele and Lewenstein 2005). This is manifested in the form of media frames in which audiences use these heuristic cues as shortcuts for processing new information in a short time (Scheufele 1999). Studies have shown that framing of nanotech has an effect on how audience perceived risks and benefits of the technology (e.g., Cacciatore, Scheufele and Corley, 2009; Cobb 2005; Schutz and Wiedemann 2008).

In essence, the mass media has a dual function. On one hand, the media are information providers that offer a source of informal learning about emerging science for most Americans. On the other hand, media frames such as the positive tone of coverage about nanotech offer audience the heuristic cues to make quick decisions about the technology (Scheufele and Lewenstein 2005). Given the overall positive content and valence of the news media on nanotech over the past few years, we postulate that mass media use will be positively associated with public support for federal funding of nanotech (*Hypothesis 3*).

Elaborative processing and interpersonal discussion

Going beyond mass media use, individuals’ cognitive processing in the form of reflective integration (i.e., news elaboration and interpersonal discussion about scientific issues) can be associated with public attitude towards nanotech. Cognitive information-processing strategies are defined (Kosicki and McLeod 1990) as “tactics that individuals use to try to cope with the amount and kind of mass media information that they encounter in their everyday lives” (p. 73). Most people are cognitive misers who tend to engage in reflective integration to sift out media messages that are useful to them. Specifically, reflective integration consist of thinking about a specific issue covered in the mass media (i.e., news elaboration) and talking about it with others by connecting it with preexisting knowledge (i.e., interpersonal discussion) (Eveland 2001, 2002; Eveland and Thomson 2006).

Elaboration is a behavioral style that people use to associate new ideas and information with what is already known, look for similarities with past experiences, and find ways to apply the information (Eveland 2002). Any new information incorporated into a pre-existing knowledge structure through the process of news elaboration will promote a deeper understanding of the scientific world. Likewise, interpersonal discussion (Kosicki and McLeod 1990; Scheufele 2001, 2002) involves talking to other people about mass-mediated issues, discussing the pros and cons, and weighing alternatives to reach a conclusion. Discussions with family, friends, neighbors, and co-workers are likely to reinforce mass media effects (Johnson 1993). Since the media has on the most part portrayed nanotech and science in general favorably, interpersonal discussion about science and nanotech should reinforce this perspective.

Reflective integration can promote a deeper understanding of the scientific world and provide a stronger cognitive base and sophisticated knowledge structure for opinion formation about scientific issues than simple factual, textbook-style scientific knowledge. By sophisticated knowledge, we are referring to the ability of individuals to associate, integrate, and relate various news issues or topics, which will also include the knowledge of how concepts within a specific domain are interrelated. We therefore hypothesize that elaborative processing will be positively associated with public support for federal funding of nanotech (*Hypothesis 4*) and that science discussion will be positively associated with public support for funding (*Hypothesis 5*).

Factual scientific knowledge

Scientists and policymakers have assumed that greater scientific literacy enables individuals to sort through the misinformation and extraordinary claims that emerge during scientific disagreements (Bodmer 1985). Scholars also assume that highly knowledgeable public would be more supportive of scientific research (Miller 1998, 2004). Scientific knowledge has been shown to have direct positive relation with public perceptions of scientific issues (Brossard et al. 2005; Nisbet et al. 2002; Sturgis et al. 2005), and to have contingent associations with public attitudes toward science and technology (e.g., Brossard et al. 2009; Ho et al. 2008; Sturgis and Allum 2004). However, some studies have shown that factual scientific knowledge had little or no relationships with public acceptance of new technologies (e.g., Allum et al. 2005; Priest 2001).We therefore pose the following research question: How will scientific knowledge be associated with public support for federal funding of nanotech? (*Research Question 1*)

Trust in scientists

Trust refers to citizens' willingness to rely on the endorsements of experts, such as scientists and regulators, as well as institutions such as the federal government, to manage risks associated with emerging technologies (Earle and Cvetkovich 1995; Giddens 1991; Luhmann 1979; Sztompka 1999). Giddens (1991) pointed out that trust in a variety of abstract systems is a necessary part of everyday life, and the characteristics of abstract systems imply constant interaction with "absent others" – people we have never met but whose actions directly affect our lives. Irwin and Wynne (1996) demonstrated that people were much more concerned with whom to trust than with the scientific aspects of an issue itself. Trust is a state-like disposition which acts as an uncertainty reduction mechanism, driving down citizens' concerns over the unforeseen risks and costs of emerging science and technologies (Freudenburg 1992, 1993; Slovic 1999), thereby enabling citizens to form judgments about emerging technology without understanding the risks involved.

Numerous studies found trust in relevant actors to be positively associated with support for emerging science such as biotech (Brossard and Nisbet 2007; Brossard and Shanahan 2003; Priest 2001; Priest et al. 2003; Sinclair and Irani 2005), gene technology (Siegrist 2000), stem cell research (Ho et al. 2008), and nanotech (Ho et al. *forthcoming*; Lee et al. 2005). Trust as a tool in decision-making is efficient when individuals have limited knowledge and personal experience, and when they have little chance to anticipate the future consequences of a particular technology (Olofsson et al. 2006). This is highly applicable to the emerging nanotech field with which most people are unfamiliar with. Therefore, it is likely that trust in scientists will be positively associated with public support for funding of nanotech (*Hypothesis 6*).

Perceptions of risks and benefits

Public perceptions of risks and benefits can be related to their decision-making about funding for nanotech. Coming from the psychometric approach, Slovic (1987) defines risk perceptions as "the judgments people make when they are asked to characterize and evaluate hazardous activities and technologies" (p. 280). Research have shown that the public tend to perceive hazards as risky if they are not within their control (Starr 1969), seem "dreadful" and "novel" (Fischhoff et al. 1978), and interfere with nature (Sjoberg 2002). The more individuals perceive a hazard or a technology as risky, the less likely they are to accept it.

Numerous studies have found that perceived risks and benefits are associated with levels of acceptance of technology (Frewer et al. 1998; Siegrist 2000; Siegrist et al. 2000; Sjoberg 2002, 2004). For example, Siegrist (2000) demonstrated that while perceived benefits was positively associated with acceptance of gene technology, perceived risks was negatively associated with support for the technology. Sjoberg (2004) opined that outright rejection of an emerging technology is often a function of perceived high risks in the technology per se. Given the fact that the “real” risks are not apparent for nanotech at the current stage of its development, and media coverage of this emerging technology is overwhelmingly positive, simply examining risks perception without consideration for the perceived benefits of the technology would preclude us from gaining a full understanding of public opinion. Hence, it is worthwhile to examine the relationship between perceptions of risks and benefits and public support for funding of nanotech. We hypothesize the following: Perceived risks will be negatively associated with public support for federal funding of nanotech (*Hypothesis 7*) and perceived benefits will be positively associated with public support for federal funding of nanotech (*Hypothesis 8*).

Methods

Our data came from a nationally representative random-digit-dial telephone survey of U.S. adult respondents aged 18 years and over (N = 1,015). The University of XXX Survey Center conducted the fieldwork between May and July 2007 with an average length of 21.47 minutes per interview. The margin of error was approximately +/- 3%. A significant amount of time and effort were put into call-backs and refusal conversions to minimize systematic non-response. The overall response rate for this survey was 30.6% (based on AAPOR response rate formula 3).

Hierarchical OLS regression analysis was used to investigate the relationships between the independent variables and public support for funding of nanotech. The variables were entered into the regression model based on their assumed order: the control variables (i.e., age, gender, and SES) were entered in the first block, followed by value predispositions (i.e., religious beliefs and deference to scientific authority), mass media use, reflective integration (i.e., elaborative processing and science discussion), factual scientific knowledge, and finally, other perceptions (i.e., trust in scientists and risks and benefits perceptions of nanotech).

Results

Table 1 shows the hierarchical OLS regression analysis for support for federal funding of nanotech. The results show that all the control and independent variables were significantly correlated with public support for funding of nanotech at the zero-order level, indicating potential multivariate relationships between them.

The first block of final standardized beta coefficients indicates the role of the demographic variables. Age, gender, and SES were initially correlated with support for funding at the zero-order level, but the significant associations were fully explained away by the independent variables that were subsequently entered into the regression model. The demographic block accounted for 6.80% of the variance in the model.

Table 1. Hierarchical OLS Regression Analysis for Public Support for Federal Funding of Nanotechnology

Variables	*Zero-Order Correlations*	*Final Standardized Beta*
Block 1: Demographics		
Age	-.15***	-.05
Gender	-.10***	-.01
SES	.23***	.04
Incremental R^2 (%)		6.80***
Block 2: Value Predispositions		
Religious beliefs	-.21***	-.09***
Deference to scientific authority	.29***	.12***
Incremental R^2 (%)		9.30***
Block 3: Mass Media		
Mass media use	.33***	.07*
Incremental R^2 (%)		5.70***
Block 4: Reflective Integration		
Elaborative processing	.31***	.06*
Science discussion	.28***	.05
Incremental R^2 (%)		2.80***
Block 5: Knowledge		
Factual scientific knowledge	.22***	.00
Incremental R^2 (%)		.00
Block 6: Other Perceptions		
Trust in scientists	.43***	.13***
Perceived risks	.06*	-.10**
Perceived benefits	.54***	.40***
Incremental R^2 (%)		14.50***
Total R^2 (%)		39.30***

*p<.05. **p<.01. ***p<.001.

When it comes to value predispositions, the negative final standardized beta coefficient shows that highly religious individuals were significantly less supportive of nanotech funding than the less religious individuals. Conversely, the positive beta coefficient indicates that individuals who had a high deference for scientific authority were significantly more supportive of funding of the emerging technology than those low in deference. Hence, both *H1* and *H2* were supported. The value predispositions block explained 9.30% of the variance in our model.

After controlling for the demographics and value predispositions, our results show that mass media use and elaborative processing were positively associated with public support for funding. However, interpersonal discussion of scientific issues had no significant association with the dependent variable. Therefore, *H3* and *H4* were supported, but not *H5*. The science media use and reflective integration blocks accounted for a combined 8.50% of the variance in public support for funding. With respect to *RQ1*, our results indicate that factual scientific knowledge had no significant association with policy choices.

Finally, the positive beta coefficients indicate that individuals who had a lot of trust in scientists were more supportive of nanotech funding than those who had a low trust in scientists. Perceptions of risks were negatively, while perceptions of benefits were positively associated with public support for funding of nanotech. This supported *H6*, *H7*, and *H8*. The final block accounted for 14.50% of the variance in our dependent variable. In total, the factors explained 39.30% of the variance in our model.

Discussion

This study examined the associations of value predispositions, mass media use, reflective integration, factual scientific knowledge, trust in scientists, and risks and benefits perception with public support for federal funding of nanotech. Overall, our findings provide support for the hypothesis that mass media use had a positive association with public support for federal funding of nanotech. Notably, the results support the hypothesis that elaborative processing was positively associated with public attitude towards nanotech. Heuristics in the form of value predispositions, trust, and risks and benefits perceptions were also shown to have bearings on public support for funding. Taken together, these findings underscore the important roles of cognitive and heuristic cues when it comes to understanding how the public form attitude towards emerging technologies. Using this holistic approach, the findings are useful for designing more effective science communication and public outreach efforts.

Consistent with results from previous studies (e.g., Brossard et al. 2009; Ho et al. 2008; Nisbet 2005), this study showed that religious belief was negatively related to public support for federal funding of the emerging technology. The normative contradictions between science and religion (Brooke 1998; Miller et al. 1997) may be an explanation for the relationships found between religious guidance and acceptance of nanotech. In addition, the fact that religious people may perceive nanotech, biotech, and stem cell research together as means to enhance human qualities, hence tampering with nature by playing God (Sjoberg 2004; Sjoberg and Winroth 1986) may plausibly explain the negative relationship.

On the other hand, individuals' deference for scientific authority and trust in scientists are two positive factors associated with public acceptance of nanotech, consistent with findings from previous research (Brossard and Nisbet 2007; Ho et al. 2008; Lee et al. 2005). Again, these findings are not surprising because, as tools in decision-making, deference for scientific authority and trust in scientists are efficient when knowledge and personal experience are limited, especially when it comes to nanotech. In addition, the independent effects of deference to scientific authority and trust in scientist on public attitudes toward nanotech suggest that researchers should adopt a fine-grained approach to examine these concepts separately in future studies as they are essentially different entities.

Next, this study shows that the public utilize positive frames derived from the mass media as heuristic cues to make decision about acceptance of the emerging technology, which is congruent to results of previous studies (Brossard and Nisbet 2007; Lee and Scheufele 2006; Lee et al. 2005; Scheufele and Lewenstein 2005) and consistent with framing effects of the media (Kahneman and Tversky 1979; Scheufele 1999). This could plausibly be explained by the fact that media outlets are the major gateway to nanotech for most Americans (Castellini et al. 2007) and that the tone of media coverage of nanotech has been overwhelmingly optimistic in the past few years (Bainbridge 2002; Gaskell et al. 2004).

Besides this, elaborative processing plays an important role in shaping public support for federal funding of the new technology. This could be explained by the fact that people who actively process and synthesize information from the mass media build a larger knowledge structure about science generally, and nanotech specifically, in their memory. This new scientific information could be easily accessed for people to formulate judgments about nanotech acceptance. Nanotech has been covered in overwhelmingly positive light in the mass media and it is therefore, not surprising that these positive information become part of the audience memory when audiences reflect and integrate the materials they attended to in the news.

Contrary to our expectation, scientific discussion was not found to be significantly associated with public support for federal funding of nanotech. Interpersonal discussion with others about scientific issues was initially correlated with support for funding at the zero-order level, but the relationship was explained away by other variables (e.g., perceived risks and benefits) that were subsequently entered into the regression model. Another plausible explanation may be that people may not be talking about nanotech per se in their discussions about scientific issues, and therefore the association with attitude towards the emerging technology is not strong.

Consistent with results of previous studies (e.g., Brossard et al 2009), individuals who perceived greater risks of nanotech were less supportive of nanotech funding, while those who perceived greater benefits were more supportive of funding for nanotech. This suggests that the public rely on risks and benefits perceptions as heuristic cues to form judgment about nanotech.

This study has important policy implications that will be useful for policymakers and science communication practitioners. Given that there are various groups that have different opinions about nanotech (such as the highly religious public), science communication practitioners should adopt the target segmentation strategy, in which communication messages are tailored to fit with publics from different social backgrounds for maximum effect. For example, to reach out to the religious public, scientific institutions should strengthen partnerships with religious institutions by arranging scientists to speak on topics related to nanotech and inviting religious leaders to address scientists on issues of concern.

At the same time, policymakers and the relevant scientific institutions should find ways to promote and instill trust in scientists and deference to scientific authority among the public (e.g., arranging eminent scientists to conduct seminars for high-school students) so as to counter the opposing force that religious guidance could potentially play in shaping opinion about nanotech. In addition, trust in nano-scientists both in academia and industry is crucial to sustain public support for nanotech. Therefore, government regulatory bodies should ensure that the necessary guidelines are in place (e.g., guidelines to manage toxicity related to nanotech and health standards for creating commercial products) so that public confidence and trust is maintained.

Given the findings that the mass media play a key role in shaping public perceptions of nanotech by providing heuristic cues and/or information, policymakers and scientists should learn to focus on framing their messages in ways that connect with diverse audience. For example, when scientists are speaking to a group of businessmen, they should emphasize the economic relevance of science by pointing out that expanded government funding would make the U.S. more economically competitive. It is important for public officials, scientists, and science communicators to pay attention to new developments in media coverage of nanotech to monitor public opinion movements, especially when the issue of nanotech enters into a different stage of the issue-attention cycle. The mass media could also be a point of intervention for public officials as they could provide accurate and up-to-date information about nanotech to the public so as to sustain positive public opinion. For example, public officials could use the mass media as an avenue, such as running campaigns and sponsoring science programs on PBS channels, to offer accurate and up-to-date information about nanotech to the public.

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Study about "Pseudo-science on Mass Media"

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Abstract. In China, after dissemination by mass media, some pseudo-scientific knowledge was popular in the name of traditional health care and specific features. However, these pseudo-science was doubted by the voices from new media, would soon be laid bare the true face. The strong contrast reflects some problems in science communication and mass media's development. Why pseudo-science can get big spread on mass media, this article tries to find out the reasons---the mass media's pursuit to commercial interests;the absence of "gatekeeper";the lack of effective communication between scientific research institutions, professional media and mass media.

After media system reformed in China, some of mass media regard ratings and circulation as the most important, and ignore the authenticity and objectivity in science communication. They prefer to report these things that can attract people's eye, even have not time and ability to verify if their coverage is pseudo-science. Scientific research institutions and professional media pay less attention to science communication,compared to research .The lack of effective communication between them and mass media,result scientific knowledge can not be transmitted to the public timely and accurately. Then,we have to receive pseudo-scientific knowledge on tv ,newspaper, magazine,etc.

Some people think that pseudo-science is just harmless fun. But some people deceive the public by fabricating and spreading false knowledge deliberately, to get money or other benefits. As the Chinese media has a strong authority and credibility the public is willing to believe the media reports. Once the pseudo-science was reported on mass media, it will have a bad effects on society.The spread of pseudo-science can damage mass media's credibility, expand the "knowledge gap" further,and is not conducive to improve chinese Scientific Literacy and Creativity.

Why pseudo-science was criticized by the whole society in a short time? The development of new media makes every person become a reporter and a gatekeeper. At the lack of communication with traditional media,scientists can use new media to communicate with the public directly, and eliminate the false and retain the true. However, each person can spread pseudo-science on new media.

How to reduce or eliminate the spread of pseudo-science on traditional media? Some successful practices abroad tell us, we should reform media system further, improve mass media's responsibility,for example, ratings should not be the only standard in television program.We should also improve the science communication capacity by urging scientific research institutions and professional media take part in science communication actively and enhance cooperation with mass media. To BBC, for example, the science documentary's script is often validated by the scientists or involved in writing in person, to ensure the authenticity and objectivity in science communication. The staff responsible for science communication in BBC, received high scientific training, some have gone beyond the identity of media workers.In essence, they have already become scientists with peculiar work way.

Emerging Trends of Media in Alteration of Mind Set for the Attitudinally Rational Society

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Abstract. Media plays pivotal role in alteration of mind set and thoughts. It also assists to reset the priority of decision to unveil the innovation and scientific rationalities for bringing the societal change. It is an axiomatic fact that knowledge is the vital factor of the human behavior, paves the path of development. Human being is blessed with the power of discrimination, which accrues the unique attributes and makes the people indifferent. Developing country like India facing the profound challenges to bring the rational changes in pre mind set of society. Science communication has the pace to bring the desirable change. Strong intervention of media offers the platform for politically aware, economically viable and ecologically balances society. Intelligently integrate our ideas and management strategies to develop strong media-led base paraphernalia to fulfill the societal needs is indispensable defy. Marshal Mac Luchan and Denial Lerner enumerated the mass media as an instrument of a social change. This paper will divulge the significance of emerging trends of media in alteration of mind set for the attitudinally rational society. Media as a medium of non-formal education assist the radical change of mindset and a strong belief in innovativeness and management-of-change concept.

Coverage of Research News in Indian Newspapers

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Abstract. The present study has been undertaken with the objective of accessing the coverage of research news cum science communication in Indian print media. A content analysis of five English newspapers revealed that newspapers published research news items relating to medical sciences, physical sciences, social sciences, business & management & IT. Frequency of R.N. is negligible, 1.2 per day per newspaper. A strong positive relationship emerged between the newspapers' readership and frequency of research news appearance. Findings indicate that newspapers reported Indian R.N. in a big way followed by US and UK. Newspapers' own correspondents and news networks wrote maximum stories rather than news agencies. The news agencies reported R.N. from different countries without any preference for their native country. The study coined two hypotheses out of which one was rejected and alternative hypothesis was accepted. The study dwelt at length on various issues relating to R.N.

Keywords: Content analysis, Print media coverage, Research news

Introduction

Kerlinger (1986) defines scientific research as a systematic, controlled, empirical, and critical investigation of hypothetical propositions about the presumed relations among observed phenomenon. Research is the locomotive in which the development of society moves forward. It is the first pillar of scientific thinking. Creative ideas and innovations originate from research. 'Why' and 'how' are the most important words in research which demystify the secrets of a particular problem under study and leads to truth and knowledge.

Wimmer and Dominick (1994) mention four events or social forces which contributed to the growth of mass media research. *First* was world war 1 which prompted a need to further understand the propaganda. *Second* was the realization by the advertisers in 1950s and 1960s the research data were useful in devising ways to persuade potential customers to buy products and services. *Third* was the increasing interest of citizens in the effects of the media on public, especially on children. *Fourth* one was the increased competition among the media for advertising dollars.

A Registrar of Newspapers for India's 2006 report states that India has 62,483 registered newspapers having a combined circulation of 18,07,38,611. Out of 8512 newspapers, as many as 6686 were owned by Individuals, 1122 by Joint Stock Companies, 260 by Societies and Associations, 222 by Trusts and 150 by Firms and Partnerships. 41 newspapers were brought out by the Central and State Governments. Cooperative Societies, Educational Institutions and the like, owned the remaining 31 (RNI, 2006). According to National Readership Survey 2006, press reach has stabilized in urban India – at 45% with 110 million readers. Press reach in rural India has also stayed the same at 19% with a readership of 112 million. Indian reader spends 39 minutes daily on an average per day. But there has been increase in urban India (from 41 to 44 minutes daily) and decrease in rural India (from 36 to 35 minutes daily) (NRS 2006).

Literature Review

Various researchers have investigated research news (R.N.) from different perspectives. Dutt & Garg (2000) found that The Pioneer , The Hindu , and The Times of India together devoted about 23 percent of the total space to items on science and technology. The sources for most of the articles (97 percent) on policy issues originated from within India, while for other stories foreign sources, including those from the United States and the United Kingdom, also contributed. Indian newspapers devoted far less than one percent of the total printed space to articles and stories related to science and technology. Entwistle (1995) reported that in medical research, journalists were more likely to cover currently topical subjects; common and fatal diseases; rare but interesting or quirky diseases; those with a sexual connection; new or improved treatments; and controversial subject matter or results. The journalists stressed that medically worthy information is not necessarily newsworthy. Koren & Klein (1991) argued that the number, length, and quality of newspaper reports on the positive study were greater than news reports on the negative study, which suggests a bias against news reports of studies showing no effects or no adverse effects. Bartlett, Sterne & Egger (2002) found that Newspapers underreported randomised trials, emphasised bad news from observational studies, and ignored research from developing countries. Good news and bad news were equally likely to be press released, but bad news was more likely to be reported in newspapers.

Objectives

1. What is the extent of research news in newspapers?
2. What are the various types of research news published?
3. What is the relative contribution of newspapers in publishing research news?
4. What kind of placement is accorded to the research news?
5. What are the different sources of research news?
6. Who are the countries whose research is reported?
7. What is the amount of space provided by newspapers to research news?
8. What is the relationship between the sources and inventing countries?
9. What is the relationship between newspapers and other variables?

Research Design

The researcher applied the quantitative content analysis technique to fulfill the objectives. Content analysis may be defined as a methodology by which the researcher seeks to determine the manifest content of written, spoken, or published communications by systematic, objective and quantitative analysis (Zito, 1975, p.27)

Newspaper selection: Three highest read English dailies (The Times of India, The Hindu and Hindustan Times), one regional daily (The Tribune) and one financial daily (The Economic Times) were taken in view of their high circulation and rainbow characteristics of regional and content diversity. TOI with circulation 11,02,521 and readership of 7.4 million, The Hindu with 11, 68,042 circulation and 4.05 million readership, HT having circulation of 113644 and a readership of 3.85 million are the three largest nationally circulated and read newspapers. The Tribune has the highest circulation with its regional flavour Haryana and Punjab regions. The ET has highest circulation among financial dailies and coverage of R.N. related to Business, management, finance etc. necessitated its inclusion.

Unit of analysis: The news headlines which consisted of words like ‘study’, ‘research’, ‘report’ and ‘survey’ were taken as unit of analysis.

Hypotheses: Types of R. N. is dominated by medical science to a large extent.

Findings and Discussions

Extent of research news

A sum total of 182 R.N. appeared in 150 editions of 5 newspapers (Table 1). The largest read Indian English daily TOI published maximum (34%) R. N. followed by The Hindu (23%), The Tribune (32), HT (14%) and ET (11%). There is an evidence that the newspapers with highest readership publish high number of R.N.

Types of R. N.

R. N. in newspapers were categorised as natural sciences, social sciences, business & mgt and IT. Natural sciences topped the chart with 67% score (Table 1). Hence the hypothesis of a big chunk of R.N. having medical science research is accepted. A random search on www.scholar.google.com and other search engines throw numerous studies on reporting of medical research whereas very little is available for other research types. Social science research came next (21%) with business & mgt. (7.7%) and IT (4.4%) categories.

In a newspaper wise analysis, The Hindu published maximum (50%) R. N. relating to IT among all newspapers. It had maximum (66%) natural sciences R.N. followed by social sciences (19%), business & mgt (5%) and IT (9.5%).

TOI put slightly more emphasis on natural sciences than social sciences followed by business & mgt and IT. It had 50% less coverage of IT R.N. as compared the The Hindu.

HT didn’t publish any R.N. relating to IT and business & mgt. It only had social sciences (31%) and natural sciences (69%) R.N. ET, emerging true to its name, had maximum R.N. on natural sciences (60%) and business & mgt (20%). A clear slump was seen in case of social science R.N. HT and The Tribune didn't have any R.N. on IT.

Table 1. Types of research news

Newspaper						Total
Research categories type	The Hindu	Times of India	Hindustan Times	Economic Times	The Tribune	
Natural sciences	28 (23)	42(34.42)	18 (14.75)	12 (9.83)	22(18.03)	122(67.03)
Social sciences	8(21.05)	14(36.84)	8 (31.05)	2 (5.26)	6(15.78)	38(20.87)
Business & management	2 (14.28)	4 (28.57)		4 (28.57)	4 (28.57	14 (7.69)
IT	4 (50)	2 (25)		2 (25)		8 (4.39)
Total	42(23.07)	62(34.06)	26 (14.28)	20 (11)	32(17.58)	182(100)

Placement of R.N. in pages

In order to ensure the meaningful categories of pages, the categorisation identified by Bansal (2002) was adopted with slight modifications (Table 2). Among all pages, it was found that maximum (25%) R.N. appeared on national pages of the newspapers. This is indicative of nationwide spread and reach of R.N. which was exposed to the maximum number of readers unlike other pages where regional customisation factor is at play. Business page had 2nd maximum (19%) R.N. followed by last page (17.5%), 'other pages' (13%) and front page (12%). The 'other pages' included regional news pages, special column pages etc. The editorial page and sports pages had equal share of R.N. (6.5%). The editorial columns mainly commented on the R.N. published mostly on the previous day and rarely on the same day.

Table 2. Placement of R.N. in pages

newspaper						Total
Pages	The Hindu	Times of India	Hindustan Times	Economic Times	The Tribune	
Editorial	2(16.66)		6 (50)	2 (16.66)	2(16.66)	12(6.59)
Front		10 (45.45)	8 (36.36)		4 (18.18)	22(12.08)
Business		20 (58.82)	4 (11.76)	4 (11.76)	6 (17.64)	34(18.68)
Sports	10(83.33)		2 (16.66)			12 (6.59)
National	2 (4.34)	28 (60.86)	4 (8.69)	2 (4.34)	10(21.73)	46(25.27)
Last	20(62.50)			8 (25.00)	4(12.50)	32(17.58)
Other pages	8 (33.33)	4 (16.66)	2 (8.33)	4 (16.66)	6 (25)	24(13.18)
Total	42 (23.1)	62 (34.06)	26 (14.28)	20 (11.00)	32(17.58)	182(100)

In newspaper wise interpretation of data, extreme distribution of R.N. spread across various pages was observed. It was revealed that The Hindu didn't have any R.N. on front page and business page and had a negligible (5%) R. N. on national page. It had maximum (24%) R.N. on sports page followed by last page, other pages and editorial page. It is evident that the newspaper selected premium pages to publish R.N.

Distribution skewness was slightly less in case of TOI which didn't have any R.N. on editorial page, sports page and last page. It published maximum (45%) R. N. on national page followed by business page (32%), front page (16%) and other pages (7%), all very important positions.

The distribution spread of R.N. in case of HT was equal across all the pages except last page which is sports page. HT had maximum editorial inclusions (50%) on R.N among all newspapers. followed by front page (31%), sports page (8%) and business page (15.4%). Editorial page is regarded as heart of newspaper and front page commands maximum OTS (opportunity to see). ET had maximum (40%) R. N. on last page. The R.N. spread across editorial, business and other pages was slightly more or less equal.

The Tribune had a symmetrical distribution of R.N. spread (none in case of sports page) vis a vis other newspapers. 'National page', business page had first and second place respectively, having highest share whereas rest all of the pages had spread in equal amount.

News sources of R.N.

Correspondents & staff reporters were the biggest source having around half (44%) share of R.N. published in newspapers (Table 3). News services/news networks and news bureaus (Times news networks, 'by our news bureau', Tribune news service etc) occupied 2nd position with 16.5% share. Among foreign news agencies, British agency Reuters contributed maximum (10%) followed by French agency AFP (Agence France-Presse) having 7.7%, Associated Press (AP) of America (6.6%) and ANI (Asian News International) with 6.6%. Indian agency PTI (Press Trust of India) had a commendable share (7.7%) at par with AFP and even more than ANI. Only two R. N. didn't have their source mentioned. This finding points towards the onus and indispensable role of journalists in promoting scientific thinking in masses by writing maximum possible R.N.

Table 3. News sources of R.N.

Source	Newspapers					Total
	The Hindu	Times of India	Hindustan Times	Economic Times	The Tribune	
PTI		6 (42.85)	2 (14.29)		6(42.86)	14(7.69)
Reuters	8(44.44)	10(55.55)				18(9.89)
Correspondents	16(20)	22 (27.50)	22 (27.50)	14 (17.50)	6 (7.50)	80 (43.96)
AFP	12(85.71)				2(14.29)	14(7.69)
AP	6 (50)	2 (16.66)		4 (33.33)		12(6.59)
News networks & bureaus		20 (66.67)	2 (6.66)		8(26.66)	30(16.48)
Not mentioned				2 (100)		2 (1.10)
ANI		2 (16.67)			10(83.33)	12 (6.59)
Total	42(23.08)	62 (34.07)	26 (14.29)	20 (10.99)	32(17.58)	182(100)

In cross sectional tabulation analysis between newspapers and sources, it emerged that The Hindu was frontrunner in publishing R.N. from correspondents followed by AFP, Reuters, AP and correspondents & staff. It didn't publish any R.N. from PTI and news networks & bureaus.

TOI, while respecting the trend, went further selective in utilizing agencies. It depended heavily on its own journalists (35%) and news network (TNN) to publish maximum R.N (32%). (rather TOI's dependence was highest (44%) among all newspapers). It also used Reuters and PTI to a great extent (16% & 9.5% respectively) and AP & ANI to the lesser extent.

HT relied heavily on its journalist for the R.N.(84%) They wrote maximum stories for the newspaper. It used negligible (7.7%) R. N. from PTI and news network & bureaus (7.7%). HT published 50% (maximum among all newspapers) of its R.N. in editorial columns which clearly reflects its editorial stance.

ET was the only newspaper which had not mentioned the source in two of its R.N. Perfectly towing the pattern line, its correspondents wrote down maximum R.N. followed by AP.

A very different scenario of pattern emerged in case of The Tribune, which contrary to the prevalent trend, had highest number (31%) of R.N. from ANI followed by PTI (19%). Its journalists wrote least number (7.5%) of R.N. among all newspapers.

Regions of Research

Asia region was ranked first with 42% share of R.N (Table 4). This region comprised India, Malaysia and Japan whose researches were reported. North American (27%) trailed the Asian region which included mainly US and Canada. Europe came 3rd (21%) in hierarchy with maximum entries from UK and one each from Germany, Switzerland, Sweden and France. Various agencies of United Nations mainly WHO (World Health Organisation) also came out with 6.6% of total R.N. An unhealthy trend of not mentioning the country was noticed in case of few R.N. The only region lagging far behind others was South America (.54%) where

Table 4. Regions of research

	newspaper					Total
Regions	The Hindu	Times of India	Hindustan Times	Economic Times	The Tribune	
North America	13(26.53)	18 (50)	2 (4.08)	6 (12.24)	10(20.40)	49 (26.92)
South America	1 (100)					1 (0.54)
Asia	12(15.78)	24 (31.57)	16 (21.05)	10 (13.15)	14(18.42)	76 (41.75)
Europe	14(36.84)	10 (26.31)	4 (10.52)	4 (10.52)	6 (15.78)	38 (20.87)
UN/WHO		8 (66.66)	2 (16.66)		2 (16.66)	12 (6.59)
not mentioned	2 (33.33)	2 (33.33)	2 (33.33)			6 (3.29)
Total	42(23.07)	62 (34.06)	26 (14.28)	20 (10.98)	32(17.58)	182 (100

only one R.N. from Chile could make it to the newspapers.

Inventing countries

In the list of inventing countries, Indian research studies were reported maximum (39.5%), see (Table 5). US research reporting came next (23%) trailed by UK (18.7%), UN/WHO (6.6%), Europe (2.2%), Malaysia (1.1%) and Japan (1.1%). United Kingdom has been separately shown from European owning to its 34 R.N. as compared to only 4 in case of other European countries. Worldwide, mostly US research is cited by researchers but the trend of rising dominance of regional research (Indian) instead of transnational one (US, UK etc) is certainly a welcome step.

Table 5. Inventing countries

Inventing countries	newspaper					Total
	The Hindu	Times of India	Hindustan Times	Economic Times	The Tribune	
US	12(28.57)	14 (33.33)	2 (4.76)	4 (9.52)	10(23.81)	42(23.07)
Canada	2 (25)	4 (50)		2 (25)		8 (4.39)
Europe	4 (100)					4 (2.19)
UK	10(29.41)	10 (29.41)	4 (11.76)	4 (11.76)	6 (17.65)	34(18.68)
India	10(13.89)	24(33.33)	16 (22.22)	8 (11.11)	14(19.44)	72(39.56)
Malaysia	2 (100)					2 (1.09)
Japan				2 (100)		2 (1.09)
UN/WHO		8 (66.67)	2 (16.67)		2 (16.67)	12 (6.59)
Not mentioned	2 (33.33)	2 (33.33)	2 (33.33)			6 (3.29)
Total	42(23.08)	62 (34.07)	26 (14.29)	20 (10.99)	32(17.58)	182 (100)

The inventing countries versus newspapers cross tabulation revealed that only ET had two R. N. from Japan and all of its research news had country mentioned like The Tribune. Only The Hindu published European research. ET and The Hindu didn't publish any research done by UN/WHO. Only US, UK and Indian research was covered by all newspapers whereas coverage pattern is not uniform for other countries' R.N.

The Hindu had more R.N. stories from US (28.5%) followed by UK (24%), India (24%) and Europe (9.5). The TOI turned out to be more patriotic by publishing highest Indian (38%) and US (22.6%) R.N. HT also trod on the dotted lines of TOI with highest Indian R.N. (62%) and exactly same pattern was noticed for ET and The Tribune. Every newspaper except The Hindu published highest Indian R.N. first and US research was accorded 2nd position except HT which gave 2nd place to UK R.N.

Space provided to R.N.

Table 6. Space provided to R.N.

	size in sq cms	%
The Times of India	9359	30.0
The Hindu	8542	27.0
The Tribune	5899	19.0
The Hindustan Times	3883	12.0
Economic Times	3570	12.0
Total	312534	100.0

Table 7

Mean space	
The Times of India	167.1
The Hindu	203.4
The Tribune	173.5
The Hindustan Times	161.8
Economic Times	178.5

The Table 6 & 7 clearly show space provided by all five newspapers in square centimetres. The total space provided by all five newspapers was 31254 sq cms. TOI provided maximum space followed by The Hindu, The Tribune, HT and ET. Barring The Tribune, the quantum of space is in perfect accordance with the readership of all four newspapers. Also, the frequency of contribution of newspapers is in perfect sync with the space provided by each of them. However, irregular pattern was observed in case of mean space. The Hindu and ET had provided comparatively high mean space to R.N. (Table 7). In simpler terms, it means that despite having less numbers of R.N. these newspapers provided good space to them vis a vis others having more R.N. and less space.

Conclusions

A strong *positive correlation* was found between the amount of R.N. and readership of newspapers. Barring The Tribune, there exists a very strong positive correlation between the readership and space provided to R.N. hence a trilogy of correlations goes like this: higher readership is correlated to higher number of R.N. and higher space. However, in a contradictory scenario, Mean space given to R.N. was higher for small readership newspaper like ET and The Tribune vis a vis others which translates into less number of R.N. but higher high print space.

Finally, it can be concluded that although one R.N. on average was published daily but it is highly inadequate to educate masses about science. This needs to be increased. Moreover, big number of medical researches and other natural science researches were highlighted discriminating others. Other types of researches should also be highlighted so that a holistic scientific temperament can be nurtured. Mere appearance of R.N. will not suffice for development and sustaining of the science communication rather those R.N. should be encouraged more which audiences can use to scientifically solve their problems themselves. More such studies covering research from various perspectives and dimensions are needed to contribute more to this area.

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Are New Media Used to Boost Social Appropriation in Latin American Countries?

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Abstract. In this paper we analyze the way in which governmental institutions in Latin American countries are implementing new media communication tools to engage the public on issues involving science and technology (S&T). Focusing on the four countries with the highest proportion of Internet users in Latin America (Brazil, Mexico, Argentina, Colombia) the paper analyzes the online communication by the representative governmental institutions in charge of S&T public policy. These institutions play a predominant role in establishing public policy in S&T and in supporting social appropriation of science. The exponential growth of Internet users in these developing countries makes the web 2.0[i] (web applications that facilitate interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web) an ideal platform not only to improve public understanding of science and diffuse every kind of science communication activities, but also to enable society to make use of scientific knowledge. Furthermore, it can serve as a mechanism for engaging citizens in setting the policy-making agenda and influencing the allocation of financial resources. The paper highlights the role of governments in challenging the still dominant assumption that science literacy is both the problem and the solution to the growing knowledge-based economy and consequently to development. Science and Technology governmental institutions need to execute all the available capabilities to *inform*, *influence* and *persuade*, utilizing innovative instruments to reach all of their different audiences (especially the ones under-target). Guided by a set of established criteria, the paper conducts a reviewing of the institutional web page of each major national S&T institution and the online communications efforts of the most relevant activities that have already been developed by that institution. The essay then offers a set of detailed recommendations for improved public appropriation of science through the development of communications strategies based in that leverage new media using.

[i] Web 2.0 (coined by Tim O'Reilly) has been noted as the shift from a flat "web 1.0" world to a more dynamic and quick changing web 2.0 world. Some of the key shifts include: the rise of social networking, online blogging, video and audio, and user generated and edited content. People browsing the web now have thousands of new tools and web sites at their fingertips to interact with people and find the information they are looking for.

Science Blogs in China: Exploring in the Forefront of Promoting Public Understanding of Science

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Abstract. As a new scientific community force, science blogs are playing a more and more significant role in science communication by exploring in the forefront of promoting the public understanding of science. Based on the analysis of the development of science blogs and their features, this presentation focuses on why and how science blogs can affect the public understanding from dimensions of the communication model, content(scientific affairs), information sender(scientists), and receiver(the public). I will also discuss the trend of science blogs in the coming world of information. Carried by science blogs and mass media, a new scientific communication ecosystem is forming.

Keywords: Science Blog; Public understanding of science; Science blog circle; Scientific communication

Twenty-five years ago, *the Public Understanding of Science* published by the United Kingdom's Royal Society argued that scientists must learn to communicate with the public and consider it their duty to do so. For decades, scientists have been making great efforts on promoting public understanding of science through the traditional mass media. Now, scientists have begun reaching out to mass audiences through blogs, by which they could communicate with the public more conveniently.

Science blogs were favored by the scientific community with the unique advantages of open, fast, interaction and efficiency. Scientists from University of Oxford held that science blogs can provide a unique educational bridge between academia and the public and distill important experimental findings into an accessible, interactive format. And the author suggested that we should create mechanisms for institutions to provide appropriate (but not stifling) oversight to blogs and to facilitate high-quality interactions between blogs, institutions, and readers. [①]

And now, Science blogs have formed influential online group power with the development and mature of blog technology in China.

The Rise of Science Blogs in China

As early as in 2006, science blogs have been basically alone in China. A reporter from the China Youth Daily wrote in a report that a science reporter wanted to understand the current thoughts of scientists through the science blogs, but he only found two science blogs through the Internet. One of them belongs to Li Miao, a researcher at the Institute of Physics of CAS. Another is Wei Yu, who is an academician of Chinese Academy of Engineering.

Four years later science blogs have developed rapidly in China. A large number of scientists, such as Zuoxiu He, Yigong Shi, Yi Rao, Nanshan Zhong etc., are expressing their views and thoughts on science through the science blogs.

It’s gradually found that those science blogs always belong to a website or several websites. The science Blog Circles have gradually thrived following the boom of the individual science blogs.

Sciencenet (http://www.sciencenet.cn/blog/), one of the most popular science blogs in China, began in 2007 and now attracts over 4,000 bloggers setting up sciences blogs and thousands of visitors. The blog aims to construct the first media of blogs circle for the global Chinese scientists. In the blog community of Sciencenet, most of bloggers are the scientists in different fields of nature science, who have always expressed their views and thoughts on the science affairs.

Another popular science blog circle is Songshuhui (http://songshuhui.net) set up by a group of science amateurs in 2008, which was awarded the Best Weblog and the Best Chinese blog in the fifth BOBs. Most of the bloogers are science amateurs. The aim of it has been vividly described as knocking the hard shell of science and helping people enjoy the inside of science. Different from the Sciencenet concerning about the thoughts of scientists, Songshuhui devotes to the creation of science popularization works.

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① Shelley A. Batts*, Nicholas J. Anthis, Tara C. Smith. *Advancing Science through Conversations: Bridging the Gap between Blogs and the Academy. PLoS Biol* 6(9): e240. doi:10.1371/journal.pbio.0060240.

Aiming at promoting academic innovation and science communication, it is worth mentioning that the first National Blog Contest in China, held by China Association for Science and Technology in 2009, has successfully promoted the great development of science blogs in China. It was reported that there were 1279 blogs participating in competition, which are from 40 sites and 8 independent domain name blogs, and the participants included 106 Doctorates, 88 masters, 117 professors, 105 researchers and 55 senior engineers. And then the CAST (http://www.cast.org.cn) set up a section about Science Blogs to spread excellent blogs from Websites.

Until now, science blogs have been developing and coming to form strong social effects in China.

New Strength for Science Communication

Professor Annian Huang, who set up website for academic exchange before (www.annian.net), now established his science blog in Sciencenet, keeping the highest personal records including 4,942 blogs, 5180,000 visits and 4,043 commentaries (Searched on August 18, 2010). Professor Huang said in *Why I established a blog in Sciencenet* that my website can't communicate with the public until now, but the blog can. It is a good form for expression of views and communication with the public.

Just as same as Professor Huang, more and more scientists who wouldn't like to contact with the media before recognize the potential value of science blogs now. They use to express themselves through science blogs little by little.

Science blogs provide a free and independent space for scientists. There actually are not enough channels from science researches to science news because of the immature science communication system in China in the past. The reports of academic conferences and the academic achievements are the common parts of science communication, which attract scientists and the public no longer.

Compared with it, what kinds of issues on earth do the scientists discuss through science blogs? We studied the science blogs community of Sciencenet, which is a large group of scientists. Eight kinds of issues are mainly discussed.

i. The Current Affairs about Science, Such as Nobel Awards in 2010
ii. The Science and Technology Policy by Chinese Government, Such as 1000-Elite Program
iii. Discussion on the Science and Technology System at Home and Abroad
iv. Commentary on Science Culture, Such as Anti-corruption of the Academic
v. Exchange of Academic Research
vi. Communicating with the Public, such as the Works of Science Popularization
vii. Communication of Teaching Between Teachers and Students
viii. Scientists Valuable Personal Experiences in scientific life and everyday life.

Those issues are involved in the majority of their discussions. It's obviously that science blogs build new platform for scientists, which enable them to enter the media system directly and participate in the science communication as independent information senders. As the sources of scientific understanding, scientists take the duty to communicate to the public more fully through the forms of we-media and hold higher authority and reliability, which is beneficial to delivering better communication results.

We took the 1000-Elite Program as an example, a hot topic in resent two years in China. I searched 61 blogs in Science blogs community of Sciencenet on July 13, 2009, by using the key word *1000-Elite Program*. Most of blogs were written by the front-line scientists and researchers, by which visitors could grasp the views on the program. Supporters and doubters had expressed the fresh ideas and even intense argument. Actually, it's hard to get this information through the traditional media. The public can understand the true thoughts of scientists and development of scientific issues.

The different between the traditional science communication and science blogs is just like the differences between 2D and 3D of Video. The public could deeply understand science and technology though the 3D world that was constructed by science blogs with the features of open, fast, interaction and efficiency.

Science blogs have changed the traditional form of science communication and provided new sources and channels for the public to understand science and technology, which play the role of guiding public opinion and promoting public understanding of science and technology attitudes in the context of low science literacy and a serious shortage of scientific information in China.

New Explorations of Science Blogs

Science blogs has changed the traditional made of science communication. Scientists directly enter the medium of science communication system and become the information sender through blogs, which showing the strength of we-medium. Does it mean that the Science blogs are perfect? The answer is no. New explorations of science blogs are carried out.

Real-name system

Science communication depends on the authority and reliability of the materials of science news. While blogs provide open platforms for bloggers, and freedom is the best character. Contradictions between the rights and responsibilities are difficult to deal with.

Based on the rules of authority and reliability, real-name system is used in the registration by science blogs community of Sciencenet. Sciencenet holds that the nature of science is the pursuit of truth. Science bloggers have the duty to be responsible for what they write.

Although the volumes of blogs are relatively small after real-name system carried out, the volumes of visits are fairly large. The views and thoughts of well-known bloggers have further enhanced the authority of science blogs, even have had great social impacts.

Combined with traditional media

A senior reporter in *Nature* Science held that journalism is in decline, science blogging is growing fast. Can the one replace the other? ①

In China, it is premature that science blogs can replace traditional journalism. As a new and helpful media promoting public understanding of science, science blogs have combined with traditional media.

More and more traditional journalists are increasingly looking to these blogs to find materials as news topics. In Sciencenet, A net community is forming through science blogs that have more influence than before. Journalists and scientists connect more conveniently.

Some blogs written by scientists have been published in the traditional media. *Science and Technology Review,* organized by the China Association for Science and Technology, set up the column of *Science Blog*, in which the excellent blogs was published.

Carried by science blogs and mass media, a new scientific communication ecosystem is forming. Xingdong Fang, father of the Chinese blogs pointed out that Mass communication is a typical cathedral model, and blog communication is a typical bazaar model. A new communication ecosystem dominated by mass communication and blog communication will be gradually formed in society, which will affect on the Internet, media, life, political, economic, social, cultural and other aspects.

The development and innovation of modern communication is providing communication platform between scientists and the public and promoting the public understanding of science. As a reporter pointed out in *Nature* that in today's overstressed media market, scientists must change these attitudes if they want to stay in the public eye. They must recognize the contributions of bloggers and others, and they should encourage any and all experiments that could help science better penetrate the news cycle. ②

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A National Channel Devoted for Science Communication (NCSC)– Need of the Day

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Abstract: India is a vast country with a wide diversity of language, traditions and culture. A large number of activities are undertaken for popularisation of science among different sections of the society. Significant amounts are being spent for these programmes. The advances in science and achievements in technologies at the National level are highly commendable. All these can reach the people, if properly pooled, suitably edited and beamed in the electronic media through a National Channel for Science Communication (NCSC), especially devoted for this purpose.

Keywords: Astronomical Events, Electronic Media, Flexitime, National Channel, NCSTC, Print Media, Science Centres, Science Express.

Introduction

Under the NCSTC banner a large number of activities are undertaken throughout the year in different parts of India to popularize science. Besides, there are various organizations, institutions, individuals and groups who have their own programs to take science to the common man. Particularly, schools and colleges organize various activities, including popularization of science on occasions like Annual Day, Foundation Day, Cultural Week, National Science Day, Technology Day, World Environment Day etc.

At the National level, we have National Children Science Congress, Indian Science Congress – a large part of which is aimed at and relevant to the common man. Mention may be made about the programmes of Science Centres under the National Council of Science Museums. Similarly the RVPSP under DST organizes the Science Express in collaboration with Foreign Societies. There are also major events like successful launching of Chandrayan-1; it's continuing sojourn and landing on Moon, future program of experiments to be conducted; participation of team of Indian Scientists in the experiment on Large Hadron Collider, by far the greatest scientific experiment ever conducted in the world.

Whereas in the former events the activities are confined to visitors and participants, only a few columns are covered in print media and a few minutes of TV coverage reaches the other areas and common public. The latter events are mostly covered in the print and electronic media only as NEWS ITEMS.

Very often the curiosity of the children and public is not satisfied in this process. It is true that some interesting events are brought out as articles in some magazines – more often devoted for other purposes. Some are available on internet to which only a lucky and privileged section have access.

Objective

A National Channel of Door Darshan devoted for programmes on Science & Technology appear to be a pragmatic solution for taking Science and Technology to everyone.

Observation / Discussion

For a moment let us consider some channels presently operating in other countries. NASA channel continuously beams programmes related to Space activities, both current launches and past programmes, trainings, seminars, talks, interviews and so on. Similarly National Geographic, Discovery channels have a lot of science components. These are costly and production of programmes of such quality and depth may be out of reach for us at present.

We should do justice by adding that some of the programmes of the foreign channels like 'Discovery'& 'Animal Planet' etc are now available in Hindi. I would still consider them as supplementary provision.

But considering activities related to SCIENCE COMMUNICATION, currently going on in different parts of our country, these can certainly be beamed in a channel devoted for this purpose. All that one has to do is to co-ordinate and pool them – if not make it mandatory to convey the recordings in e-media - to a central point, edit them by an expert group and beam them in the channel.

In our country we have enough talents to communicate Science in a number of INNOVATIVE WAYS which does not reach many corners of our vast country and its heterogeneous public.

Thanks to NCSTC, already the methods of communication have been standardized and are popular. Similarly, technologies are available for rendering texts in one language to any other Indian language.

Crores of rupees are spent, in our effort to communicate science, for production of software which remains confined to limited regions and becomes only a ritual. On the other hand if the details are beamed in a National Channel more people will be benefited.

I quote below some reports, views and reviews on Science communication published in newsletters and books.

“Why Science Communication

“Science Communication Programmes and Activities have an important role to play for developing a scientifically informed and attitudinally rational society, by way of interpretation of scientific knowledge and scientific concepts to the public through different mass media-Print, Broadcast, Folk, Interactive or Digital, sustained Science Communication efforts play a key role....”

“The Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad established in 1982 undertakes a broad spectrum of activities concerning S&T communication targeted at various segments of our society laying emphasis on...”

“Reaching people using all possible media both traditional and modern and by employing software in their own language.”

The third independent review held in 2001-02 assessed about 25 programmes of the Parishad. (I refer to only a few concerning TV).

- **Kudratnama**–A popular science TV quiz for school children-27 episodes
- A TV series titled **Vigyan Ki Rahein** – under **Krishi Darshan**
- Collection of data from organisations engaged in S&T popularisation in Delhi and Haryana.
- National Children Science Congress, since 1997.
- National Science Day celebration spread over a month.
- Country–wide programmes for Scientific Awareness and safe observation of total Solar Eclipse on 24.10.1995 and 11th August 1999.”

Let us take the case of National Children Science Congress. It has become almost a mass movement (students). But think of the larger mass of students in remote corners, who have neither been able to participate nor have an exposure of the apex level. Think of what would be their joy and benefit if they are shown a glimpse or more of the programme, exhibits, presentations etc.

Take another case of Science Express. It would be relevant to quote the views of Mr. Chander Mohan.

“Science Express is an innovative Science Exhibition mounted on specially designed train. This state of the art exhibition will cover about 17,000 kms over six months and halt at 51 Railway Stations.....The major objective of this unique venture is to nurture curiosity amongst our youth and rekindle their interest in science.”

This programme is being repeated very often, almost every year, in collaboration with foreign institutions. The contents are simply superb, stupendous, awe inspiring, highly educative and valuable. One laments to think of the large of student population and public who are deprived of a closure look, if not physically, at least by other audio–visual media. In fact, one would go further and say that a mass briefing before the express reaches the station would be highly beneficial to the visitor for understanding and appreciating better. A TV channel proscribed for Communicating S&T, I hope will serve the best interest.

Regarding efficacy of Mass Media like Radio, the author has experience in one such event. Way back on October 24, 1995 there was a major Astronomical Event viz; Total Solar Eclipse (TSE) viewed in India. Elaborate arrangements were made in the Pathani Samanta Planetarium (PSP) premises for observing TSE. In addition, PSP collaborated with AIR, Cuttack to arrange for a “running commentary” of the event as it progressed in different locations in India. It was interspersed with scientific information related to the event. This created not only interest about the event as a “Natural Phenomenon” in the minds of the people in the remote corners of Orissa but also helped in dispelling superstitions and blind beliefs about TSE. Just imagine what would have been the effect had it been telecast in TV with running commentary!!

Felt Need of TV Channel

For communicating Sc & Tech the acute need of a TV channel has always been felt. To quote Mr. Subir K.Sen

[3] "Science shows & documentaries are another very important communication mode for science. Unfortunately we do not have any TV channels or slots in any channel for transmission of indigenous Science Technology & Industries (STI) matters. Our interested persons or viewers are to satisfy themselves from foreign CD's and channels such as Discovery, Animal Planet & BBC.

I know of the nice science program in English by Mr. Samir Bagchi and team, serialised in National Network of Door Darshan..... Cannot we have some arrangements for knowing existence of such items and see them if need be."

Thus our Elite people, Scientists and Technologists, over the years, have always expressed the need of a TV channel of Science, devoted for Science and Science alone.

Inference

The advantages of Television are:

- TV is audio – visual
- TV can reach more people simultaneously.
- It is flexitime.
- Programs can be available and expected in one particular channel.
- NCSC can be an alternative to channels meant for "Entertainment" and 'News' about which much can be said.
- Production cost would be minimal as many of the programs to be beamed are / would be available in e-form having been prepared at various locations.

Conclusion

The role of Print Media, Radio or other e-media cannot be underestimated. However the advantages of Television appear to be enormous, considering the mobility and other modern technologies by which the communication can reach every individual.

In India's perspective, considering its diversity of population, locations, languages, cultural backgrounds, on one hand and technologies available, money being spent for current programmes and economic viability on the other hand, the national channel has immense potential.

Recommendation

Hence we should recommend for setting up A National Channel For Science Communication (NCSC) under the aegis of Door Darshan. It would be relevant to mention that Door Darshan is not a paid channel. Hence NCSC can be made to be freely available through all cable operators.

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Science Communication through Mass Media: Coverage of Science in Tamil Satellite Television Channels

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Abstract. According to Harold Lasswell, one of the important social functions of the media is providing information about events and conditions in society and the world. Also it should facilitate innovation, adaptation and progress by providing information. So Media has an important role in disseminating science and technology related issues to the people.

India witnessed media revolution in the nineties. The media world was revolutionized by the technology advancements, liberalized policies of Indian government, burgeoning of media houses and commercial objectives. Particularly the television medium developed a lot.

It is significant to study the role of Tamil television channels in science communication. Thanks to the number of Tamil television channels, we watched the launching of satellites; solar eclipses; scientific advancements. So we can have a quick look on some of the programmes of television channels which focuses on science and technology.

The purpose of the present study is to find out the coverage of science in Tamil satellite television channels; this research addresses the following questions. What is the extent of science coverage in Tamil satellite television channels? What are the content characteristics of science content in Tamil satellite television channels?

The present study employed qualitative method to study the coverage of science in Tamil satellite television channels. The researcher used observation method for the study. The data revealed that Tamil satellite television channels gives less importance to science and technology content. Sun TV, Chutti TV, Chittiram TV and Makkal TV have allotted time for regular science and technology programme. Most of the science content is in the form of discussion, puzzles, quiz, stories, and demonstration. The content also includes pictures, illustrations, animation, graphics and colorful photographs. Hence, some of the Tamil television channels are concentrating on science and technology. But they are very minimal.

Coverage of Science & Technology in Indian Newspapers: A Content Analysis Approach

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Abstract. Science communication has become essential for the development and prosperity of any nation. In the country like India where superstitions still prevails and hinder all the efforts of developments, science illiteracy cannot be ignored. It is required to put utmost efforts to make people scientifically aware, by informing, educating and explaining them about science and technology. Media can play a tremendous role in disseminating scientific information in interesting manner. Numerous research studies has been conducted in India and abroad to find out the coverage of science and technology in media which reveal that the amount devoted to it is very substantial. Present study focuses on the amount of space given to science and technology in national newspapers, comparison of coverage in Hindi and English newspapers, and the format being used in disseminating information. Research also focuses on the preferences to the subjects on which newspapers present more information and the sources of information whether Indian or foreign. The research methodology which is used is content analysis.

Keywords: Science, Technology, Communication, Coverage, Newspapers, Space

Scientific Temper, Science Communication and Print Media

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Abstract. Scientific temper may be considered as a state of mind and behavioural outlook where a citizen undergoes an organic transformation with scientific awareness accrued through various channels of scientific communication. The attainment of scientific temper is a pre-conduction for the development of any society. In traditional societies like India, the communication of science was poised by print media during the yester-years. But the advent of visual media poised a severe challenge to print media when the print concentrated more sensationalism, crime, politics and cinema, providing only less importance to science. The print media can again become an effective tool for science communication by solving various problems with respect to scientists, and science communicators.

Keywords: Chain reaction, Deadline, Interpersonal communication, Ivory tower approach, Mass communication, Media mix, Peer-review, Public awareness, Science communication, Scientific temper, Three pillar theory

Towards Scientific Temper

Scientific temper is an attitude of mind which calls for a particular outlook and pattern of behaviour. It is neither a collection of knowledge or facts, although it promotes such knowledge and rational thinking. Creation of scientific temper is more a matter on the social agenda than on the scientific and technological agenda. Hence its impact with respect to any traditional society is much greater than the spread of science and technology

Creation of scientific temper is not synonymous with mastering of science and technology or developing a highly industrialised society. It is rather an attribute of human mind and of social decision making process, than knowledge of various branches of science. The inculcation of scientific temper in our society would result in our people becoming rational and objective, thereby generating a climate favouring an egalitarian, democratic, secular and universal outlook. Hence it should become a part of human culture, a philosophy and a way of life which leads to pursuit of truth without prejudgement.

People must be involved in the process of science. Public awareness and understanding of science and resultant public participation in the debate on issues of science, technology and environment having societal impact is a prerequisite for development and hence became very important for the progress of any society. That may be the reason why democratically elected governments all over the world is actively thinking on appropriate strategies to instil scientific temper in traditional societies. Only with the active involvement of the mass media, this onerous task could be undertaken. Unfortunately the mass media generally adopt an attitude which encourages an irrational outlook and thus become a stumbling block in the path of creating scientific temper.

It is not an easy task to create scientific temper in the minds of people. Scientific knowledge and scientific information could be imparted through the effective use of media and other mass communication techniques. But scientific temper is a sort of mindset which is totally different from scientific knowledge and awareness. Propagation of science through mass communication and inter personal communication in a simple style on a continuous basis will pave for the creation of scientific temper. Hence science communication can be considered as a means to achieve the ultimate target, establishing of scientific temper among the grass root level of the society.

Studies proved beyond doubt about the impact of media moulding the views of a society. Mass media is considered as the most potent form of communication to popularise science. Communication of Scientific knowledge through media is generally considered as science communication. There are a number of modes of communication to propagate science like interpersonal communication, group communication, mass communication or digital communication. But in traditional societies where literacy, customs and beliefs prevail, the effective channel for communication is Mass communication, using mass media where the messages are reinforced by interpersonal efforts.

The process of mass communication is having proven abilities to interact with people with different colours, races and cultures settled in different geographical areas. Inter personal communication helps to reinforce ideas and beliefs transmitted by various means of mass communication.

Though the general impression is that the visual media which synergised with audio and video inputs have a greater impact on members of traditional societies where rate of literacy is high. The educated elite as well as the poor believe the power and credibility of print media. Print is the oldest medium of communication having a permanent format, longer storage life and an ability to cater the local communities. In a sense, it is interactive also. Further, print media has catered and is still catering science than other media and provide space to science and technology reporting in the past.

But the growth of visual media,raised a challenge to print media in reporting science and it is loosing interest in reporting science gradually, perhaps due to their growing attention to counter the emerging challenges of visual media. Journalists attributed the reason for this antipathy as the disinterestedness of readers. As in the case of crime, cinema and politics, there is no persistent demand from readers for science news. The failure to create such an interest is due to the lack of vibrant grass root level agencies. A joint effort of scientists, science journalists (communicators), and the readers who are the three pillars of science communication is needed to boost science coverage. These three pillars are interdependent, though seem to be independent.

In many countries, especially developed nations world-wide, the growth of, science communication has a direct link with scientific advancement, research activity and allied S&T progress. They are mutually dependent to a large extent. But there are exceptions to the general rules as in the case of Kerala which is a state in the Indian Union, having very high literacy level, where even journalists who shows disinterestedness to publish matters on scientific programmes on the pretext that their readers have no interest. But no serious media research has been conducted so far to prove the veracity of this point, or to test the veracity of the age-old myth. Kerala state is a classical sampling unit to conduct such research because it is the first state in India achieved 100 percent literacy. Besides Kerala is having an age old tradition of science communication through print media. The first science periodical, agricultural periodical and health periodical in any of the Indian regional languages were originated in Kerala in the regional language Malayalam during the beginning of 19^{th} century.

While analysing the Kerala society as a whole, we have to come to a conclusion that the print media had played a yenon role in the social transformation in Kerala. The agricultural revolution as part of the *Grow More Food campaign* (in connection with the *Green revolution*) became a success, only due to the organised campaign of print media during 1950’s. The spread of health consciousness, sanitation and awareness in modern medicine including vaccination and application of antibiotics which increase the health expectancy of average Keralate is also due to the committed effort of print media. But when the visual media coupled with digital media reign the scene, the scenario the print media slowly withdrew from the area of science popularisation.

The ABC (Audit Bureau of Circulation) figures and readership surveys categorically asset the fact that print media commands a better influence and circulation in such traditional societies. Though the society depends the visual media for entertainments, the people are looking print media as the source of information on science, literature, arts and even politics.

The failure of creating scientific literary and scientific temper is due to the absence of vibrant agencies functioning in the society. Though the Government and other agencies are pumping a lot of money for propagating and popularising science, the grass-root level organisations including voluntary agencies have failed in their duty. The messages transmitted through the media would only be cemented with the help of interpersonal communication and group communication organised by voluntary agencies and committed and efficient science teachers. Unless the grass root level voluntary agencies are not functioning with a missionary zeal and social commitment, science popularisation would continue to remain as a distant dream.

Three Pillar Theory

Parliament, Executive, Judiciary and Press are known as the four pillars of democracy. These four estates are independent and interdependent. The synergy formed by the effective functioning of the four pillars is the basis of any healthy democracy. Similarly science communication also needs the synergy formed by the collaborative activity of the three pillars for its success. They are scientists, science journalists (communicators) and the readers. Synchronisation of all these three elements is the key for successful science communication through print media. This process can generally be concluded as the *three pillar theory of science communication*.

The non-interest of journalists in reporting science which is a recent phenomenon is due to the lack of a pressing demand from the readers and general public. It is the habit of Kerala society to read at least a newspaper in the early morning. They would usually react only if the issue reported is volatile and totally against the basic tenets of society. Since science reporting is generally cold and inert in the hands of an inefficient writer, as there is not much scope for such a reaction from the society. Unless and until there is a pressing demand from society or public, journalists or media management would not act. The pertinent question is why people are not keen on science and why they are not demanding for science in a palatable way from the newspaper which they subscribe.

Such a demand would be evolved only if the citizenry in general is well aware of the implications of science reporting. They do not know the way through which science transform their lives by lock, stock and barrel. Without a sense of scientific temper and awareness, we can't expect a positive and pro-active response from the society.

Lack of understanding and mutual credibility between the three pillars, will upset the noble intention of science communication for sustainable development and the ultimate result is the erosion of credibility. Concrete steps have to be designed to fill the lacunae created between the three pillars of science communication. Otherwise the creation of scientific temper among the masses would still remain a mirage, even though Kerala society is at the threshold of scientific development and the citizens have nearly-cent percent literacy. Strengthening the activities of science communicators and voluntary agencies are the need of the hour for propagating scientific thinking which ultimately prompt the media to devote more and more space for science news in their editorial-mix.

In the case of sports, cinema, crime and politics, the public awareness is so strong and the media cannot evade the responsibility of reporting such events. Omissions in the follow up of stories on hot issues will not be tolerated by the readers. Hence the media personnel are trying to provide even the minute details of such events with a pinch of sensationalism. Creation of scientific awareness is not an easy task. The genesis and development of awareness can be affected only through vibrant and grass root level organisations. The awareness will ultimately leads to scientific temper. The conclusion is the theory of chain reaction, where Poor *Awarenes on science leads to zero science news which ultimately results to zero supply of Science News.* It is interesting to note that the growth of science coverage has become inversely proportional to the growth of literacy and scientific advancement in the typical literate society like Kerala. A media observer could well understand the fact that a sharp decline in the science coverage in print media occurred during the recent times when compared with the previous century in Kerala. The phenomenon happened at a time when science and technology are advancing by leaps and bounds. The literacy rate of Kerala at present is around 100 percent compared with a meagre 10-15 percent in the previous century. This paradox indicates a peculiar tendency in the print media scenario in areas like Kerala. Perhaps, the people are not demanding for science coverage and that may be the reason why journalists are not interested in science coverage.

There are many other reasons for the lack of science coverage other than the affinity for sensationalism, lack of mutual respect or erosion of credibility between science communicators and scientists. The lack of empathy among the journalists towards their target audience is another problem. Failure of a journalist to link his science reports with its impact on society is detrimental for his report. Journalists are generally not interested in logically analysing the scientific issues or contributing to the issues by way of research and reference. Even if some factual errors are occurred in science reports, the 'gate keepers' of the society are not interested in making corrections or providing interpretations to the needy public. The writers are not interested in simple writing by avoiding jargons. The lack of persons with scientific back ground and absent of regular science beat in newspaper offices is another problem. During the past century, newspapers were widely considered as a vehicle for social transformation and anything published in it were considered with great reverence and credibility. Unfortunately the media mix has changed and science is getting lesser importance. But readership surveys in traditional societies proved that the print is most potent medium in mass communication.

Problems with Journalists

It is generally believed that the reason for the lack of science coverage in print media is the non-interest of the journalists. Science reporting is time consuming and it needs more effort and research. A fairly good background in the area of reporting is also necessary. The process of science writing also warrants more attention rather than writing on crime, politics, cinema or culture which are comparatively easy to report. However, there are many more reasons attributed to the media allergy to science reporting.

The general criticism against journalists is their innate affinity towards sensationalism. It is attributed as a force with potential to boost readership and hence the circulation. The tendency may be considered as an effort to combat the increasing influence of visual media with all its entertainment channels. But science is a subject having less scope for sensationalism. Epoch making inventions are rare. However, journalists celebrate such scientific events with much fanfare and enthusiasm. The newspapers are ready to publish news and features on a commendable invention in science with due or rather undue importance. On such occasions every effort shall be made to simplify the matter by avoiding technical jargons and the news is presented with a lot of illustrations and comments if necessary. But the phenomenon is not regular and the scientists as well as journalists never tried to pursue the trail of such incidents in a continuous manner, thereby maintaining the scientific-tempo created with such events. If a joint effort could be mooted, we would have good, simple and interesting science coverage throughout the year in a sustainable manner. There is no regular science beat in majority of language newspapers.

Non-availability of journalists with proper science background and understanding to cover science and technology events is yet another problem. Journalists usually approach science reporting with a pre-conceived notion that the same is totally alien to them. So they are not ready to apply their logical mind which ultimately resulted in the publication of a bad report. Even if some persons have scientific bend of mind, they also ignore logical thinking, sense of interpretation and inquisitiveness in science coverage. People have a general tendency to ignore global issues like Global Warming or climate change on the presumption that such issues never affect them. The reason is the laxity of communicators in conveying the message in an appropriate format to the general public. Science journalists should take the pain to describe how such global issues would affect an individual (or his kith and kin) wherever he be.

Reporting day-to-day affairs like politics and crime are comparatively easy. It is somewhat routine too. Consider the example of sports reporting. In sports, the rules of the game are known. Change is only in the players and the places. But science is new and the situations as well as the players are changing always. Further, the details and implications of scientific developments are known only to a few and hence science coverage demands more effort. Scientists generate ever-newer knowledge and reporters should keep up with such developments. Research, reference and sometime interviews are necessary to make a good science story.

Research is the systematic investigation and study of materials and sources for establishing facts and to reach conclusions. Hence it is cumbersome and difficult to achieve deadlines for a science reporter.

The general compliant about science news reports and articles is the excessive use of jargonised language. The reckless use of jargons, clichés and technical language in writing science for newspapers made the reader tired and distanced himself from reading such pieces. Tendency of making the news story complex and complicated kills the interest of subscribers in reading science. The tendency of making science news complex is due to the lack of empathy, rather than the so called inability of journalists to do research or reference.

If an error appeared in a science story, or something is misquoted or misrepresented, generally no newspapers in the regional language come forward to set matters right with correction and proper clarification, as in case of political or crime reporting. It may be due to the absence of genuine reactions from the scientific community or from less vigilant subscribers. Such mistakes may appear in plenty in science stories which erodes the credibility of popular science reports among the right thinking persons in the society.

The media people are not much interested in writing follow-up stories in science and technology. Journalists have a presumption that nobody in the society is interested in science reports. Most of the journalists are not even ready to think about the possibility of linking science reports with its social significance and its role in alleviating the miseries of the common man. An orientation and social commitment from the part of the journalist is the basic necessity for an effective science report.

Responsibility of Scientists

Journalists are not the only culprits who deprive the right of citizens to know more on science through various columns of a news periodical; but scientists are equally responsible. Scientists are ignorant of the impact of their inventions on society and are not ready to share their knowledge; many researchers are reluctant even to speak to the popular press, for fear of having their carefully chosen words twisted beyond recognition. Communication through conventional channel of peer-review and acceptance are their priority. Lack of understanding of people's priorities and inability to write for public, keeping them away from popular science and the ultimate tax-payer is ignored. Further, the scientists are quite unaware of the news value of their findings and its impact among the citizens. Hence they are bound to share the responsibility for the never-ending ignorance of people and lack of scientific temper. Most of the scientists prefer to remain silent in their ivory-towers leaving the taxpayers at dark. Perhaps, it may be due to their fear to communicate with the press or the anxiety about the sensationalism and speculative type of reporting adopted by many reporters which may cause embarrassment, and putting 'black marks' in his profession. In between the widening clash of interests, the worst sufferer is science journalism and the loser of the game is none other than the common man. In such a situation the noble intention of the government to propagate science among the masses will continue as an accomplished dream. And the scientific inventions and research findings would end in the cupboards of scientific institutions.

Conclusion

The most effective means of science communication to establish scientific temper is print media. In the past, it had nurtured the curiosity of mankind and there by pave way for the popularisation of science. The English language press is still continuing this rich legacy. Unfortunately the so called regional press which is having more power to transform the society is lagging behind. Science coverage in print media can be initiated only on the basis of a push originated from the ultimate readers, and that too is possible only with the help relentless efforts of scientists, journalists non-governmental organisations in the grass root level of society and good science teachers in schools. Unless readers demand for science news, journalists will not respond affirmatively. Mere science news for the popularisation of science won’t help to achieve the target of creating scientific temper. A mental transformation or metamorphosis is needed to sow the seeds of scientific temper in the minds of citizens for making their life better. Science

Communication and popularisation are a prologue for such thinking.

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Scientific Temper, Science Communication and Print Media

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Abstract. Spread of scientific temper in a society is having much more impact than the spread of science or technology. But scientific temper is neither a collection of knowledge or facts, although it promotes such knowledge and rational thinking; but is an attitude of mind which calls for a particular outlook and pattern of behaviour. Creation of scientific temper is more a matter on the social agenda than on the scientific and technological agenda. Hence its importance with respect to any traditional society is much greater. Creation of scientific temper is not synonymous with mastering of science and technology or developing a highly industrialized society. It is more an attribute of human mind and of social decision making process than knowledge of various things. The inculcation of scientific temper in our society would result in our people becoming rational and objective, thereby generating a climate favouring an egalitarian, democratic, secular and universal outlook. Hence it should become a part of human culture, a philosophy and a way of life which leads to pursuit of truth without prejudgment. People must be involved in the process of science. Public awareness and understanding of science and resultant public participation in the debate on science having societal impact is a prerequisite for development and hence became very important for the progress of any society. Hence every democratically elected governments all over the world is actively thinking on a strategy to instill scientific temper in traditional societies of developing and under developed countries. People from all walks of life, especially media men have to come forward and join hands to undertake this onerous task. Unfortunately the mass media generally encourages an irrational outlook and thus become a stumbling block in creating scientific temper. Cinema, Radio & TV is no exception. Since, all of them have a powerful impact in moulding the views of a section of people, mass media is considered as the most potent form of communication to popularise science.

Communication of Scientific knowledge through media is generally considered as science communication. There are a number of ways of communication to propagate science like interpersonal communication, group communication, mass communication or digital communication. But in traditional societies where literacy and superstitions prevail, the only channel for communication is mass communication. There are a number of means of mass communications like Radio, TV, Internet and print media are in use. In mass communication, which are having proven abilities to interact with people with different colours and cultures settled in different geographical areas. Inter personal communication helps to reinforce ideas and beliefs transmitted by various means of mass communication. Though the general impression is that visual media has a greater impact, members of traditional societies where literacy has considerable influence, believe the power and credibility of print media. It is the oldest medium of communication having a permanent format and an ability to cater the local communities. Further, print media is catering science than any other modern age media.

However the sad plight is the lack of interest of the print media in science coverage. Journalists attributed the reason as the disinterestedness of readers. But the general rule is that there will not be any uninterrupted supply of science news through media, if no persistent demand from readers. The failure to create such an interest is due to the lack of vibrant grass root level agencies. Scientists, science journalists (Communicators), and the readers are the three pillars of science communication. They are interdependent, though seem to be independent. But journalists have a strong bias towards sensationalism and Scientists have a tendency to keep themselves on the ivory towers of research, keeping away from the society. There are many other reasons for the lack of science coverage other than the affinity for sensationalism, lack of mutual respect or erosion of credibility. Most of the newspapers in developing / third world countries are not having a regular science beat, just like criminal beat, fashion beat or political beat. Lack of trained Journalists with science background is another problem. Inability to use simple language, absence of research and reference, lack of follow-up stories and space constraints in newspapers are some other problems. The lethargy of a large chunk of scientists in providing news on science to the fellow citizen and their strong affinity towards publication in peer-group journals, followed by the so-called ivory tower approach, is also help to widen the gap in science communication. However, the readers are not demanding for science in their daily media mix. Their interest is mainly concentrated on politics, crime, cinema & sports. Unless and until a compulsion is originated from the part of readers, the journalist community will not go for science, backtracking from their traditional. Conclusion: The most effective means of science communication to establish scientific temper is through print media. But science coverage is print media can be initiated only on the basis of a push originated from the ultimate readers, and that too is possible only with the help relentless efforts of non-governmental organizations in the grass root level of society. Unless readers demand for science news, journalists will not respond.

Keywords: Scientific temper, Print media, Group communication, Mass communication, Traditional societies, Science beat

Risk communication, Media Discourse, Influenza A/H1N1, Argentina

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Abstract. Mass media plays a quite important role in the social construction of reality. This is a well known affirmation. That is why to analyze mass media coverage clears up our understanding of the society which we live. The influenza A/N1H1 pandemic declared by the World Health Organization (WHO) in 2009 is both a good example of this situation and an interesting way to search in depth the social construction of reality by the media. This is also even more significant because the influenza A/N1H1 crisis combined local and global health, economic and social risks. We assume the characteristics that allow to understand this pandemic as a risk can be situated within the conceptual framework developed by sociologists like Beck (1996, 2002, 2008) Giddens (1990, 1996) and Luhmann (1996) that, with different approaches and perspectives, have explained the dynamics of risk societies. The link between the modalities of risk in modern societies and mass media coverage is also a remarkable aspect, since media discourse is deeply connected with the social perceptions of risk. The main purpose of this paper is to examine the media coverage of influenza A/N1H1 pandemic made by three Argentine newspaper of reference in the construction of the social and political agenda. The period explored goes from April 25, when the news first appeared, to July 31, 2009, when the pandemic reached the highest level of dissemination in Argentina and also coincided with the maximum level of exposition in the mass media. The study of this particular health emergency caused by the influenza A/N1H1 pandemic provide us an empirical and analytical updated about some traditional issues of media coverage of health risk communication under epistemic and social uncertainty. The methodology is based on the social discourses theory proposed by Verón (1998, 2004). Through this perspective, we study the discursive operations which define the "way of saying" of each newspaper on risk. The analysis detected specific discursive operations which delineate particular features of the conceptualization on the risk magnitude constructed and communicated by the media. "Uncertainty", a key concept in the social theories of risk, risk communication and the public understanding of science field, was also detected as an essential component within the corpus reviewed. In fact, it is relevant as a media discourse "productive condition". Taking this into account, we can say that all the newspapers examined show a high degree of ambivalence to establish the magnitude of risk. We explored how the intensity of risk, as a measure of uncertainty, is expressed into particular "discursive traces". We identified keywords and linguistic operations that refer to two semantic axes built up from different binomial to define risk. The first one refers to influenza A/H1N1 as a health threat for individual and different social levels (economic, political and social). The main binomials of this axe are "risk/safety", "threat/safety", "unknown/known". The second one reflects the emotional; that is to say, the risk perception as a mood. The binomials included within this axe are "concern/unconcerned", "fear/fearlessness", "madness/common sense", "pessimism/optimism". It should be noticed that each binomial have degree in valuations, and they are not excluding between them.

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Keywords: Risk communication, Media discourse, Influenza A/H1N1, Argentina

Building Networks Better Science Journalism in Africa

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Abstract. The Issue: Science has not been a very popular subject in the mass media but it is still regarded as important by the mass media in much of the advanced world. In Africa, and sadly so, it hardly has a place. While majority of the media rarely reports science local or global, most of those who do only cut and paste third party news and features from foreign papers and websites. Original reporting is glaringly missing. Local scientists suffer while the gap created is easily filled by sensational stories of pseudo-scientific claims and other hoaxes. True as it is that science journalists alone cannot account for robust science communication, the mass media is a critical success factor. That is why it is extremely important to build the missing capacities and networks that are necessary in mainstreaming science in the mass media. I will be interested in sharing my experiences which span mentoring, training and network building in aid of science journalism across Africa hoping to gain new perspectives and relationships.

Keywords: Africa; Science Journalism; Networking

Reporting Science and Technology in Print and Electronic Media

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Abstract. The advancement in communication technology has made a huge growth in media industry and also has given a freedom to set new professional trends. The convergence is apparent in many different ways. Media is growing and flourishing but with this growth many questions are emerging on the credibility of its content and the journalistic norms which print and electronic media are inheriting.

A free market gives birth to the opportunities for growth and also freedom and confidence to explore new things. Media is not only a great source of information but it also gives us a platform to raise our voice. It is a fourth pillar of the democracy which has the power to ask questions. Media can set new trends by making people as well informed citizens at the same time media has the power to influence public understanding on subjects like science and technology.

To get the answers of all these questions the researcher has done a study of print and electronic media for her PhD, for which the topic was "Reporting Science and Technology Communication in print and Electronic Media" study, was a content analysis of two mainstream newspapers and Four TV channels.

It was found in the study that people are very much interested in reading and watching science and technology news/ programs but they are not satisfied with the quantity of coverage being given by TV channels and newspapers to science and technology. Foreign channels like Discovery and National Geographic Channels which shows higher percentage of science and technology programs shows more foreign countries based programs. National News channels hardly cover science and technology in news shows. The survey of the school kids, college students and professionals shows that they want a channel devoted to science and technology news and programs. They want to see what is happening at world level in the field of science and technology but they are not getting that kind of information from media. Even the content of the programs does not match with viewers/ readers choice. While the coverage of science and technology in print media improved over the years, they are not only giving more space and importance.

Keywords: Science and technology, Readers and viewers, Content, News shale, Prime time, News papers, News channels, Purpose, Treatment of the program

Introduction

The advancement in communication technology has made a huge growth in media industry and also has given a freedom to set new professional trends. The convergence is apparent in many different ways. A free market gives birth to the opportunities for growth and also freedom and confidence to explore new things. Media can set new trends by making people as well informed citizens, at the same time media has the power to influence public understanding on subjects like science and technology. To get the answers of all these questions the researcher has done a study of print and electronic media for her PhD, the topic of her study was "Reporting Science and Technology Communication in Print and Electronic Media" was a content analysis of two mainstream newspapers and four TV channels.

Method of Research: Qualitative and Quantitative

General objectives of the study

1. To identify the information needs of the audiences.
2. To evaluate the percentage of science and technology based news in print media.
3. To analyze qualitatively the extent of coverage and relative importance to various issues in print and electronic media.
4. To evaluate the percentage of science and technology based news in selected TV channels.
5. To evaluate messages of science news in print.
6. To evaluate messages of science news in television.
7. To assess the relevance of science and technology reporting to their utilization.

Specific objectives of the study

- To analyses percentage of news shoal devoted to science and technology news?
- To understand how much space is covered by foreign news and how much covered by Indian news related to science and technology?
- To understand what is the content and structural element of the news of science and technology?
- To evaluate and comparatively analyze science and technology based news on TV Channels and reasons of selecting news and programs of some specific categories of science and technology.

Time Band

Two months for newspapers and four months for four TV channels (One month for each channel)

***Languages*:** English **-** Hindi

***Sample Size*:** Two mainstream Indian Newspapers comprising Hindi and English languages and four channels of electronic media i.e. Doordarshan, National Geographic, Discovery and Aaj Tak

Data Collection

1. Questionnaire for interviews with school children, college students and professionals
2. Questionnaire for interview with science communicators and journalists
3. Log Sheet for Data collection of the News items and programs of newspapers and TV channels

Findings

Part I: *What reader/ viewers think on science and technology, their knowledge on subject and coverage in newspapers and TV channels?*

Results shows that readers/viewers are pretty conscious about what is being telecast on different channels and published in newspapers on science and technology, they were showed high interest in reading and watching science and technology related news and programs. Readers and viewers were not satisfied with coverage being given by newspapers and TV channels to science and technology. They wanted a separate page in newspaper and a separate channel for science and technology. At the same time they showed keen interest in programs which can provide them knowledge and entertainment. Study shows that readers/ viewers think that science and technology not only update the knowledge but also improves their quality of life and mindset. For most of respondents science and technology related information means:

1. Information on happenings in the field of science and technology at world level
2. Information on science and technology news that directly affects our day-to-day life.
3. Information on new inventions and discoveries
4. Information on new researches
5. Information on space science

On the basis of readers/viewer's choice of most relevant categories of science and technology, researcher opted only these five categories for the further analysis of newspapers and TV channels and monitored only those news and programs.

Part II: *What science communicators, journalists and scientists think on Science and Technology Coverage?*

- Experts view shows that people have interest in science and technology news and programs; however media is not generating awareness among people by giving more coverage.
- It reveals that information about changing patterns, new findings and discoveries, news worthiness, relevance, news which develop scientific temper among people, awareness generation should be the criteria for selecting science and technology news.
- It shows that wide coverage of science and technology can help in changing people understanding about the subject.
- Research findings shows that scientific controversies are good but they should not be cheap and shallow.
- Experts views shows that science and technology coverage helps in fostering better understanding and practices in the society.

Part III: Analysis of Newspapers

The Times of India

- Category–The category which was covered in the news items of the Times of India newspaper in higher percentage was "what is happening in the field of science and technology around the world.

- Columns–The space given to science and technology news in the Times of India Newspaper was not sufficient. The news stories published in two columns were higher in percentage.
- Geographic Focus–The study revealed that the percentage of science and technology news was higher in percentage on the international page.
- Type of news stories–It was found that most of the science and technology news was published as the other news stories.
- Tables–The number of stories, which were published without tables, was higher in percentage.
- Statistical Formula–The number of stories, which were published without statistical formula, was higher in percentage.
- Mathematical Formula–The number of stories, which were published without mathematical formula, was higher in percentage.
- Visuals–The number of stories, which were published without proper visuals, was higher in percentage.
- Story Source–In this study researcher discovered major change in the findings, it was found that the number of news stories with Indian Source was higher than one with the foreign source.
- Tone of News–It was found that the stories with positive tone were higher in percentage.
- Purpose of news–The researcher found that in the Times o India Newspaper the maximum coverage was given to news stories which were scientifically explaining the unusual events, phenomenon, claims and reports.

The Hindu

- Category–It was found in this part of analysis of newspapers that the category which was covered in the news items of The Hindu newspaper in higher percentage was "Information on new Researches".
- Columns–The news stories which were published in four columns were higher in percentage.
- Geographic Focus–The study revealed that the percentage of science and technology news was higher in percentage in the special edition of Hindu Newspaper which published every Thursday by the name of science and technology page.
- Type of news stories–It was found that most of the science and technology news was published as the other news stories.
- Tables–The number of stories, which were published without tables, was higher in percentage.
- Statistical Formula–The number of stories, which were published without statistical formula, was higher in percentage.
- Mathematical Formula–The number of stories, which were published without mathematical formula, was higher in percentage.
- Visuals–The number of stories, which were published with proper visuals, was higher in percentage.
- Story Source–In this study researcher discovered major change, it was found that the number of news stories with Indian Source was higher than one with the foreign source.
- Tone of News–It was found that the stories of positive tone were higher in percentage.
- Purpose of news–The researcher found that in the Hindu Newspaper the maximum coverage was given to news stories which were scientifically interpreting complex phenomenon, research and development results and scientific work in laymen's language.

Analysis of TV Channels

Doordarshan

- Researcher recorded one month prime time news from 8 PM to 8.30 PM.
- In one month study, the total number of news stories telecasted were 138, while the news stories on science and technology was only 14, which means only 10.14% coverage

Aaj Tak

- The researcher recorded one month prime time news from 8PM to 8.30 PM
- Total 161 news reports were telecasted and 91 news programs of high hour duration were telecasted but no news report or program was telecasted on science and technology.

Discovery Channel

- The researcher analyzed one month programs of Discovery Channel; total 920 programs were telecasted from the channel.
- Out of which 49 programs with repeat telecast were based on science and technology.
- If we can remove the numbers of repeat telecasts only 19 programs were telecasted on science and technology.
- Out of 19 programs on science and technology only one program was based on Indian science and technology.
- Out of five categories selected for the analysis of science and technology only one category "What is happening in the field of science and technology around the world" was covered in most of the programs telecasted from Discovery Channel.
- Researcher found that out of some units decided for the measurement of the purpose of the program, the unit which was mostly covered in the programs was "Bring out the potential of scientific/technical inventions in research and development works in an area.
- It was also found that most of the programs were in documentary format.
- The study revealed that research, good scripts, excellent camera work and good narration were some of the incentives of the interest of the programs.
- The analysis of objectives and concept of the program showed quality of content, treatment and presentation of all the programs telecasted from Discovery channels was good.
- Duration of each program was one hour.

National Geographic Channel

- The researcher analyzed one month programs of NGC, total 900 programs were telecasted from the channel.
- Out of which 69 programs with repeat telecast were based on science and technology.
- If we can remove the numbers of repeat telecasts only 12 programs were telecasted on science and technology.
- Out of 12 programs on science and technology only one program was based on Indian science and technology.
- Out of five categories selected for the analysis of science and technology only one category "What is happening in the field of science and technology around the world" was covered in the programs telecasted from NGC.
- Researcher found that out of some units decided for the measurement of the purpose of the program, the unit which was mostly covered in the programs was "Bring out the potential of scientific/technical inventions in research and development works in an area.
- It was also found that most of the programs were in documentary format.
- The study revealed that research, good scripts, excellent camera work and good narration were some of the incentives of the interest of the programs.
- The analysis of objectives and concept of the program showed quality of content, treatment and presentation of all the programs telecasted from Discovery channels was good.
- Duration of each program was one hour.

Conclusion

- Readers and viewers were pretty conscious about what is being telecast on different channels on science and technology and also what is being published in the newspapers. Results of this study revealed that respondents were very much interested in reading and watching science and technology news/programmes. They wanted a separate page in newspapers and a separate channel for science and technology programmes. However, they also showed keen interest in programmes which can provide them knowledge as well as entertainment through such programs. Responses showed that science and technology news not only update the knowledge of readers/viewers but also improves quality of life and mindset.

- At the same time, it also comes out from the study that readers/viewers are not satisfied with the quantity of coverage being given by TV channels and newspapers to science and technology news. The study examines the programmes of two of the most popular channels Discovery and National Geographic Channel which give a wide coverage to science and technology programmes. They telecast science and technology related programmes on a regular basis but the programmes are generally based on researches done in foreign countries. It was found that though the quality of production and content in all their programmes was very excellent, these two channels still do not satisfy audiences' needs as far as quantity is concerned, especially in the context of the number of programmes based on Indian science and technology.

- More focus on country specific topics by understating the information needs of people will not only help in making channel more popular but it will definitely help in generating a scientific temper among masses.

- Channels which telecast news for 24 hours. It is an ample opportunity to cover science and technology news. But as discussed the coverage of science and technology news is very less, regional and need specific issues hardly get any place in the television programmes. It was found in the study that news channels do not give much coverage to science and technology news/programmes. It was also found that there is no regular slot for the science and technology news/programmes during the primetime on Doordarshan and Aaj Tak Channel. The irregularity in science and technology news/programmes definitely affects the interest of readers and viewers. These findings also match with the hypothesis of the study.

- The content of any science and technology news/programmes plays very important role in deciding its quality. However, sometimes the content of a programme does not match with the choice of viewers/readers, which is one of the reasons behind lack of interest in science and technology news/programmes. Sometimes television channels overlook viewers' level of knowledge, choice, interests and expectations. Hence, science and technology related news/ programs should be published/aired in a simple language to increase their popularity.
- Continuity and repetition of programs, time, space, topic, quality, presentation, readers/viewers' need and usefulness of the topic also play a very important role in holding the public attention.
- For readers and viewers, proximity matters a lot. If the televised/published content is not related to their area, they lose interest in the programme/news.

- Similarly, viewers/readers have a keen interest in the news/programmes, which provide them some answers or solutions of their day-to-day problems, needs and queries.

- The study reveals that these are some of the points which have been overlooked by the newspapers and TV channels in their science and technology news/programmes. These findings also match with the points which researcher had mentioned in the hypothesis of this study.

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An Analysis of Message Diffusion within the Blog Community in India: Innovation–Diffusion Model Approach

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Abstract.
Purpose: Viewing the blog technology as an integral part of the current social-technical environment, this research aims to investigate whether the main influences on message diffusion within a blog community originate from external mass media channels or internal interpersonal communication channels.
Research Methodology: This study addressed two research questions:
RQ1. Which channel, interpersonal or mass media, provides the main influence on the message diffusion in a blog community?
RQ2. How does the external mass media influence the message diffusion in a blog community?
Specifically, I aimed to understand whether the interpersonal communication power in blog community would be influenced by the presence of a large number of news items related to the same topics being reported in the mass media. Furthermore, because the typical diffusion curve had an S shape, the diffusion patterns might differ between before and after the inflection point. I treated the week with the most news reports appeared in the mass media as an inflection point, which was used to divide the entire diffusion period into two distinct data sets. I then analyzed the patterns and explanatory power for changes between before and after the infection point. This methodology allowed us to determine whether the number of articles in a blog community increased due to the large quantities of related news items reported by the mass media.
Findings: The results indicate that the mass media is the main source of message diffusion and that the internal communication power may increase as the opinion leader promotes these messages.
Research limitations/implications: Other factors that may influence message diffusion such as topic, design characteristics, and the existing social network have not been included.
Practical implications: For practice, the result indicates that the mass media and the blog might complement each other.

Keywords: World Wide Web, Communication, Mass media, Social networks

Using Social Media to Spread Science and to Engage Readers in Conversation

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Abstract. In this paper, we examine "the top 20 Most Popular Science Websites" as established by eBizMBA (eBusiness Knowledgebase) in July 2010, based on three major traffic ranking websites. These top 20 websites includes magazines, blogs aggregators, a press release aggregator, research institutes, academic journals and so on. We aim to understand how popular science websites use the Web and its social features to communicate science and to engage the readers in conversation. We analyze these top 20 sites by focusing on how they display their information and use social media to interact with their readers. Moreover, we complete this study by analysing their behaviors on Twitter. Finally, we discuss our findings and how science websites spread information and stay connected with their readers.

Keywords: Media, Science news, Scientific communication, Social web, Twitter

Introduction

The Web 2.0 is interactive, real-time, and let everyone contribute. It eases the dissemination of information by allowing anyone to publish, share and comment content on the Web [9]. It thus provides a large amount of free-access information available online. However, this raises some issues on how to retrieve the relevant content and to give credibility and trustworthiness to a science website.

The Pew Internet Survey [4], conducted in USA, have found that 20% (40 millions) adults use the Web to get science news and information, while television remains the first source with 41% (newspapers and magazines get a score of 14%). However if they need to search for specific scientific information, then the Web is users' first source according to this survey: "The Internet is a research tool for 87% of online users (128 million adults)". However, more than a research tool, Web 2.0 allows also users to react to what they read. [3] wisely encourages users to be more active on the Web and to interact with journalists, experts and so on. He aims "to help people become active and informed users of media, as consumers and as creators". Indeed, we believe that letting readers to ask questions, to discuss with authors, experts, journalists, etc. are an important element of a democracy. Therefore, we were then interested in understanding how the most popular science websites use Web 2.0 features to provide their readers with opportunities to comment and share information.

In the next section, we review some of the current challenges for science writers and science websites. In Section 3, we present our methodology and describe the analysis of the top 20 science sites in Section 4. Subsequently, we examine how these websites use Twitter in Section 5. Finally, we conclude our paper in Section 6.

Motivation

A challenge for science writers

Being a science writer on the Web requires new skills in addition to the ability of writing well and communicate science facts. This include having multimedia competences [2] and being able to up to date information in real-time (as opposed to printed news that cannot be edited once they are published). Science writers now need to interact with their readership and adapt their process accordingly, while they were used to produce information and then let the audience passively consume it.

Web 2.0 not only challenges the profession; it also provides opportunities. For instance, the formatting of articles on the Web generally provides more space for science news, whilst this is a constraint in printed version [13]. However, since anybody can publish science news on Internet, science writers' profession is then truly affected and needs to redefine its mission and habits, if writers do not want to be bypassed [14] and still want to make a difference compared to others writers.

Indeed, scientific content produced by scientists themselves can be freely accessible [13] for any interested users. Moreover, as surveyed by [7], researchers try to directly address themselves to a broader audience in order to share their knowledge and expertise.

Furthermore the top 20 (see Table 1) shows the interest by the audience to such content, since it includes academics sites such as sciencedirect.com, an academic database. It also contains sites written by researchers for a broader audience such as scienceblogs.com. This is in our opinion an interesting aspect, as this kind of science website was not included in the classification provided by [13], which shows a fast and growing evolution of the online science news ecosystem. Indeed, as described in Section 3, this top 20 includes different types of sites, emphasising the variety of content and creators that one may find on the Web.

Credibility of online scientific content

We believe that the Web helps the dissemination of scientific messages. However it raises also many concerns about the difficulty for users to establish the value, credibility, reliability and trustworthiness of scientific information they browse [8] [12]. Indeed, this information available online can be created by anybody, making more difficult to differentiation between a site and another.

[11] studied the factors that influenced people about the credibility they give to a science website. They distinguished users with low involvement in science from users with high involvement. The three criteria used to judge the credibility of a science website are the domain, the popularity and the attractiveness. They found out that a website using the .gov extension (reserved to governmental sites) is perceived as more credible than a .com extension (that everyone can buy). Another study [8] concludes that information professionals - such as librarians - are key players to help users to retrieve valuable information and then enhance perception and awareness in science. The Pew Internet Survey [4] reveals also that 54% of online science consumers go to the original source of the information retrieved to check the reliability of the news. According to [11], the characteristic related to the completeness of the information and its verifiability is important for an audience highly involved in science.

Methodology

We analyzed the top 20 most popular science websites established by eBizMBA[1] (eBusiness Knowledgebase) in July 2010 (See Table 1). Their ranking is based on the average of the three following traffic rank websites[2]: Alexa, Compete and Quantcast. In order to figure out how sites display their content and use social media to interact with users, we manually read and analysed between 10 and 15 random news items from each science website, leading to a total of 253 news analysed[3]. We selected articles from different categories such as "top stories", "technology feature", "favorites", "editor's choice", etc. We also studied the website's blog, if any. We followed a similar process for each sites. We mainly observed (1) the general information displayed (author, date, contact), and (2) the social aspect it provides, such as comments, integration with Web 2.0 sites like Facebook and Twitter (we will describe these sides in section 4.2), etc.

Finally, we observed the Twitter account of these science websites (see Section 5). By studying the conversational patterns (such as replies) of these websites on Twitter we could establish why and for which purposes they use it, i.e. to interact with others or simply to spread information.

Table 1. Top 20 Most Popular Science Websites, July 2010.

	Science website	Unique visitors/month
1	howstuffworks.com	12,000,000
2	noaa.gov	10,000,000
3	discovery.com	9,400,000
4	nasa.gov	8,900,000
5	sciencedirect.com	4,500,000
6	sciencedaily.com	2,400,000
7	nature.com	1,800,000
8	treehugger.com	1,700,000
9	popsci.com	1,400,000
10	scienceblogs.com	1,250,000
11	physorg.com	1,200,000
12	newscientist.com	1,000,000
13	livescience.com	950,000
14	space.com	750,000
15	scientificamerican.com	700,000
16	redorbit.com	600,000
17	sciencemag.org	550,000
18	eurekalert.org	400,000
19	hubblesite.org	350,000
20	sciencenews.org	250,000

[1] http://www.ebizmba.com/articles/science-websites (July 2010)

[2] http://www.alexa.com, http://compete.com, http://compete.com

[3] http://noaa.com/ has not been studied due to "Server not found" error

Dataset Description

We identified two main characteristics in our dataset (see Table 1). The first aspect is the website's origin, i.e. whether it was directly a Website, or was created from a genuine media, such as a scientific newspaper or magazine. Five websites are the online version of a printed edition: popsci.com, newscientist.com, scientificamerican.com, sciencenews.org and nature.com. Nasa.gov, noaa.gov and hubblesite.org are websites of research institutes to communicate about research and outreach science and technology accordingly. Finally, discovery.com was first a TV channel. Interestingly we noticed the inverse phenomena for howstuffworks, the number one in our top 20 science websites (see Table. 1), which could get a TV version[4]. The 11 other sites are educational website (howstuffworks.com), science blogs (treehugger.com, scienceblogs.com), science news (livescience.com, space.com, redorbit.com, sciencedaily.com, physorg), academic database (sciencedirect.com), academic journal (sciencemag.org) and press release aggregator (eurekalert.org).

The second aspect we identified is websites aiming to display sources such as academic papers or press releases. For instance, sciencedirect.com is a scientific database, nature.com is a scientific academic journal and eurekalert.org is a press release aggregator. Nasa.org and hubblesite.org also provide press release. Such a science websites included in the top 20 show a will from the audience to have access directly to sources usually used by science writers to report on findings.

Thus, the list of the top 20 science websites ranged from websites providing access to academic papers, to sites delivering press release, through news and stories outreaching findings and more generally science and technology.

Authorship

For a news item, displaying the name of an author in addition to his title and/or a brief biography might help the readers to give credibility, reliability and trustworthiness to the website. We thus checked that first characteristic and also looked at whether authors provide email address to be contacted by their readers.

80% of science news items that we studied were signed by authors, while 15% could not be specifically identified. For instance, some articles from space.com are signed "TechNewDaily Contributor" or "space.com staff". Physorg.com does not systematically sign their news, but the copyright is given at the end of the article such as "©2010AFP". 5% articles from our whole dataset are not signed at all. Moreover, 62% of the articles observed do not provide author's title or author's biography. For sites such as nasa.gov and hubblesite.org, this information might not be essential to give credibility to the news since the website itself is identified as credible according to [11]. In contrast, scienceblogs.com displays an author's biography on the left column of the website. Another criteria we looked at was the creation date of the article, helping to put a story into context. 98% of our dataset provides this information. Furthermore, we explored whether or not an email address was given. We made the difference between the ability to contact the site and the capacity at emailing an author specifically. In the latter case, only 22% of science news studied displayed such information. This information was given especially by sciencedirect.com, eurekalert.org, nasa.gov and scienceblogs.com. These websites, as described earlier, display either press release or publications; which imply to give contact information. News items posted on scienceblogs.com are mainly written by scientists, for whom such information may be a mean to discuss their research interest and increase their network.

Overall, we did not identified specific patterns that would allow us to make a difference between sites. Most of them display the authors' name with a tendency to not add his title / biography and a contact.

Analysing how they engage users in conversation

We then observed how readers can be engaged in conversation, by studying the comment section of news items and their integration with social media services such as Facebook and Twitter.

About 30% of sites do not provide a comment section. They are mainly represented by nasa.gov, sciencedirect.com and eurekalert.org, which provide press release or academic publication. Therefore, as seen earlier, these sites do provide email but do not allow comments. Regarding the news allowing public comments, very few of them got reply by the article's

[4] http://www.howstuffworks.com/about-hsw.htm

author. We noticed that only scienceblogs.com made a visual distinction between author's comments and users' ones, which allows readers to solely follow author's comments if wished. Furthermore, we observed that the comments' number tend to be lower than the number of posts on Twitter, Facebook recommendations or bookmarks using Digg, when this data is available such as in Figure 1. Here, a news from sciencemag.org had only 3 public comments but 570 recommendations via Facebook and 136 links from Twitter. This may reveal a will by readers to engage conversation with their community using their Twitter or Facebook accounts.

Twitter, Facebook, personal email, Delicious and Digg are the five most popular way of sharing an article in our dataset. Delicious and Digg are two social services allowing to bookmark pages. Facebook is a social network service with more than 500 million active users and “more than 150 million people engage with Facebook on external websites every month”[5]. Finally Twitter is a free social media service launched in 2006. In September 14, 2010, it had 160 million registered users with 90M tweets written per day[6]. It allows users to spread update to their followers up to 140 characters. Anybody can follow users of their choice, which do not imply reciprocity.

Therefore, personal email implies predefined recipients while Facebook and Twitter are addressed to a larger community. However, Twitter is the only one with an open audience, which allows to achieve a wider diffusion and also offers the ability to engage authors or science websites with their readers, without the need to know or follow each other.

We also analysed whether these websites are present on such services or not. 11 have a Facebook account, 17 a Twitter account including 7 with a Twitter account but no Facebook one, while 3 do not have accounts on these services (sciencedirect.com, nature.com and sciencenews.org). However, in this paper, we will not discuss the strategy and motivation behind those websites to get an account or not.

The following section presents a analysis of how Twitter is used by these websites. Indeed, we believe Twitter has this potential to enhance conversation between experts, science writers and broader audience [7]. Moreover other surveys showed that 19% of Web users use status-update services, such as Twitter, to share and see updates online [5].

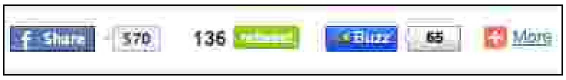

Figure 1. Comments versus Social Media
(From http://tinyurl.com/298t46b, taken on 30 October)

Twitter analysis

To establish our dataset, we distinguished official accounts from other accounts using same usernames (but created by fans for instance). Therefore, we searched on websites' homepages whether or not they have a link to a Twitter account. By doing so, we could trust the provenance of a Twitter account. However, when no link was provided, we manually search on Twitter for such an account, looking if it was certified or not (see Figure 2.) We then analysed the Twitter feed of 16 websites (Table 2). This dataset does not include nature.com and sciencenews.com since they do not have a Twitter account, nor hubblesite.gov and space.com due to technical errors in our crawling methodology (described next). Moreover, while @usnoaagov, @sciencedirect, @sciencedaily, @scienceblogs and @redorbit are not certified account, we kept them in our dataset.

During 4 consecutive days, we crawled (1) the Twitter feed of these 16 Twitter accounts, leading to a total of 1560 tweets (i.e. Twitter messages) and (2) all tweets containing a reply to any of these usernames (following the @username pattern) (Table 2), leading to a total of 6932 replies. We then noticed a high tendency from users to engage with these science websites on Twitter. The following section describes in further details the results. In addition we manually noted the number of followers and followings of each Twitter account. Followers being users who follow the update of the Twitter account @user_A. Followings being users followed by @user_A. Then by following the classification suggested by [6], we established 15 of them are likely to belong to the media category (which is actually the case) since their number of followers is much more superior to the number of followings, while redorbit.com got a higher score of following versus followers.

[5] http://www.facebook.com/press/info.php?statistics
[6] http://twitter.com/about

Figure 2. Certification Twitter Account

Analyse of our twitter datasets

To analyse the tweets displayed by science websites and replies addressed to them, we studied the following conversational patterns containing into the original tweets: replies (@username) and hashtags. This latter is a commun practice that consists in using keywords in messages, marked as #tags. We also studied the retweets to see if they are a way to engage conversation [1]. “Structurally, retweeting is the Twitter-equivalent of email forwarding where users post messages originally posted by others” [1]. In addition, we also looked at the proportion of hyperlinks.

As shown in Table 2, most of the accounts largely include links into their tweets revealing a will to use Twitter to widely spread their news. While 7 accounts seem to use Twitter solely in that purpose, the others tend to add conversational patterns into their tweets, such as @discovery and @sciencedirect that get a high reply score. Also @discovery and @eurekalalertaaas tend to add tags into their tweets, which may help them to be reached by users outside their community who follow the tags. Finally @sciencemagazine, @treehugger and @discovery seem to retweet often.

Table 3 shows the conversational patterns used in replies addressed to these accounts. It shows a global tendency to get tweets addressed to science websites accounts, especially @nasa, @treegugger and @newscientist who get respectively 1478, 1033 and 781 distinct users interacting with them. Interestingly as described in Table 2, they are also part of the accounts that use conversational patterns. Therefore they are likely to use Twitter to engage users in conversation. We also have accounts such as @sciencedirect that only get 2 replies with zero retweet, while 85% of their orginal tweets contain a reply pattern. Yet, @popsci use Twitter to only spread links, but get a high score of retweet from 227 distinct users.

In conclusion, Twitter is mainly used by science websites to spread news via hyperlinks

Table 2. Analysis of the Conversational Patterns in their tweets

	#tag (%)	@user (%)	Link (%)	RT (%)
@howstuffworks	0	25	86	16
@usnoaagov	12.5	0	92	0
@discovery	42	70	62	23
@nasa	3.5	27.5	79	12
@sciencedaily	0	0	100	0
@sciencedirect	0	85	15	0
@treehugger	11	22	96	24
@popsci	0	0	100	0
@scienceblogs	0	0	91	0
@physorg_com	0	0	100	0
@newsientist	20.5	10	90.5	4
@livescience	0	0	61.5	0
@sciam	2	5	95	13
@redorbit	0	0	100	0.5
@sciencemagazine	11.5	3	94.5	25.5
@eurekalertAAAS	25	72	100	16.5

and to try to reach more users. These tweets are then well retweeted by users as shown in Table 3. Hashtags and replies are used by some science websites Twitter accounts. In the future, we will go further in the analysis to figure out the quality of the conversation and the profle of the users.

Conclusion

In this study of the top 20 science websites, we outlined the current tendency by users to visit websites not only written by science writers, but also sites that distribute sources such as academic papers and press release. Moreover, the presence in the top 20 of sciencebogs.com shows also the popularity of news written directly by researchers to a broader audience. Furthermore, readers seem to prefer engaging conversation using social media services where they have an account, rather than directly on the website. We also observed that the Twitter accounts of science websites are mainly used as a mean to reach more readers than to engage with users.

Finally, based on our result we believe that Twitter might be a relevant service to engage readers in conversations on scientific and technologic topics.

Table 3. Analysis of the patterns in messages addressed to science websites

	#tag (%)	Link (%)	RT (%)	Users (number)
@howstuffworks	42	42	53	158
@usnoaagov	46	63	63	102
@discovery	24	29	49	487
@nasa	16	55	38	1478
@sciencedaily	19	86	60	119
@sciencedirect	0	0	0	2
@treehugger	24	81	46	1033
@popsci	34	77	66	227
@scienceblogs	6	96	24	190
@physorg_com	14	63	69	294
@newsientist	30	56	70	781
@livescience	21	95	73	49
@sciam	19	67	65	437
@redorbit	8	67	40	19
@sciencemagazine	35	70	63	87
@eurekalertAAAS	20	70	81	19

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Trends in Climate Change Coverage in India: A Case Study of Three Leading National Newspapers in India

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Abstract. Climate change and environmental risk is one of the major issues in the twenty first century. Intergovernmental Panel on Climate Change (IPCC) has asserted serious concern over anthropogenic climate change in various times. Complexity of environmental issues, comprehension gaps for these matters and language of science topic stands as barrier between mass audience and the matter itself. Mass media undeniably is the major role player in stimulating public debate and shaping public opinion on scientific questions and issues as well as in policymaking process. In this paper, coverage of climate change in three leading newspapers of India has been analyzed since February 2005 to January 2010. The study includes qualitative and comparative content analysis of three major English dailies of India–The Times of India, The Hindu and The Indian Express. Order of the journalistic norms for presentation of this global issue has also been analyzed. This study also reflects public-participation throughout the time span that takes in to two major events in climate change movement–Kyoto protocol and Copenhagen summit.

Science Communication in West Bengal: Role of Mass Media

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The first Bengali essay on science was being published in 1818 in the magazine called Digdarshan with an initiative of the Christian missionaries of Sreerampur. Kolkata Book society also took major initiatives to publish science related journal in the year 1812.But science communication should not be confined within the framework of magazines. It can be asserted that science communication became possible from the day on which people of Bengal could feel the essence of science and Bengali simultaneously. But the main thrust of our paper is the progression of science communication in Bengal during post-independence era.

Before entering into the arena of science communication, let us discuss a little bit about communication. Communication is the process of sending and receiving information. It is the vehicle through which we develop, maintain and improve human relationships. Communication word is drawn from communis (Latin derivation), which means common; the idea of commonality is frequently stressed in dealing about communication. According to National Communication Systems, UNESCO, Communication is part of the very fabric of society. It takes place at all levels between peoples and between institutions, from government to people, from people backs to government and through many channels both inter-personal and mediated. Communication expert Berlo said, "Communication does not consist of the transmission of meaning. Meanings are not transmitted or transferable. Only messages are transmitted and meanings are not in the message, they are in the message users." Even in MacBride Commission's report (1978), namely 'Many Voices, one World' explain the communication process as the motor and expression of social activity and civilization. According to this report, Communication maintains and animates life; it leads people and peoples from instinct to inspiration,, through variegated processes and systems of enquiry, command and control; it creates a common pool of ideas, strengthens the feeling of togetherness through exchange of messages and translates thought into action, reflecting every emotion and need from the humblest tasks of human survival to supreme manifestations of creativity-or destruction. Communication integrates knowledge, organization and power and runs as a thread linking the earliest memory of man to his noblest aspirations through constant striving for a better life.

Human civilization has been possible due to evolution and revolution in communication process. Science and technology could never be possible without underlying developments in communication. Communication can be formal or informal. Communication of science is a specialization in itself. Science communication is a discipline that has developed rapidly in theory and in practice since 1995 in the whole world. Though science communication initiated in India in early 19^{th} century, but it was remarkably developed in mid of 20^{th} century. In Australia, in 1996, the formation of the Centre for the Public Awareness of Science (CPAS) at the Australian National University (ANU) heralded the start in the science communication movement. The new approach aimed to involve the public more in the processes and culture of science, to create an awareness of what science was attempting to achieve, to cultivate the 'need to know' that is the hallmark of good communication.

It has become an important issue of public policy since 1990. It is, however, one of respectable antiquity, dating at least from the origins of the Royal Society in the seventeenth century. For examples of eighteenth and nineteenth century science communication. Indeed, it has been argued that the purpose of the Royal Society was one of communication, to assist in the application of the 'New Philosophy' to the defence of the Realm, most particularly by way of the Royal Navy.

It is commonly accepted that there are five general categories under which arguments can be made for the importance of the communication of science. They are (i) the economic argument (the contribution science can make to the national economy and individual wealth), (ii) the utilitarian argument (people owe much of their health and well-being to scientific invention), (iii) the democratic argument (to be fully informed enfranchises people), (iv) The cultural argument (the best science is, in company with the best of other areas endeavour, high art) and (v) the social argument (at every evolutionary stage – stone, bronze, iron, industrial, biological – science underpins the evolution of society).

Communication in science can be at different levels and of different kinds:

- Primary Communication where a scientist communicates to peers, colleagues and fellow scientists. This communication can be seminar presentation, short rapid communication like ‘Letter to Nature’, research papers and review articles.
- Communicating to students and learners, which include classroom lectures, demonstrations, writing of textbooks and so on.
- Journalists’ reporting and news items communicated through press conferences and mass media both in print (newspapers, magazines, periodicals etc) and electronic form, they include science newsletters, news digests newspapers and channels, and in such publications as New Scientist, BBC Science News Channel, and PTI Science etc. Amalgamations of traditional media and modern mass media originate a new kind of communication process especially in third world countries. Interactive media like Internet plays a pivotal role in today’s science communication.
- Popular level communications are those, which meant usually for general public. In such communication, communicators may be scientists, writing on their own specializing field as also on other fields. J.B.S. Haldane, Gopal Chandra Bhattacharyya, Abdullah al Muti Sarafuddin etc. are examples who wrote profusely on subjects both of their specialties and beyond their specialties.
- Communication to children and juveniles – is a special breed of science communication and is probably most difficult one. Illustrations are the most supporting factor in such communication.
- Another very important communication modes for science are documentaries and science shows.

Dr. Manoj Patairiya in the portal of UNESCO said that -“one of the reasons for the science reporting to have remained underdeveloped in our country may be due to the fact that except for a few dry and drab articles, technical information or news, and hardly any other modes of science writing were employed. May be this is why common man could not come to terms with science and technology. If science is presented in the form of stories, poems etc. common man not only would be able to read, but also would understand and appreciate science

But country like India is though progressing in fascinating way in the field of science and technology, but far lagging behind in communicating science to the common people. In the arena of space programme, atomic energy production and consumption, oceanography, biotechnology, information technology, electronics, - India is progressing rapidly. Indian society has reached a complex socio-economic and cultural stage. It differs from the western world in which Philip Cambell is experiencing a glut in science communication. The literacy rate in our country is very low, the science literacy is much limited and only a thin section of society is aware of frontiers in science, e.g. the information technology and biotechnology. The public and the leaders in various sectors whether illiterate, literate, educated, professionals or executives live with philosophical conflict of religion and science and cultural conflict of tradition and modernity.

An increase in coverage of science in our media seems to follow the world trend, which is predominantly occupied with the abstracts of the stories of neurobiology, biomedicine, astronomy, and information technology, etc. Cambell agrees that the media stories speak very little about the public understanding of science but he believes that it will automatically grow over the years due to the public interest for science. This view looks oversimplified in the Indian context, which possesses a very heterogeneous public significantly differing in socio-economic, cultural and philosophical levels.

Science communication has been a major concern in the country for several groups of people over the years. Certain government, non-government and voluntary agencies have been experimenting with programmes predominately with the involvement of school children. They have developed many new ways of science communication, e.g. performing and folk arts forms, joy of learning with plays and toys, discussion forums, science clubs, seminars, explaining and exploring miracles and mysteries, children science congress, nature watch and excursions, slide shows, planetarium, exhibitions, science parks, etc.

More seriously planned agenda and policies for science communication in a truly transparent manner are a pre-requisite to organize and speed-up science communication in India for the new millennium and to develop a public consciousness of the issues and the understanding of science in a more strategic manner. We have to be more methodological and institutionalized on one hand, to consolidate, and to go beyond all the institutional and framework boundaries with several innovative ideas to expand, on the other.

In India, historically, the importance and application of modern science and education emerged during the 19th and the first part of 20th century chiefly under the colonial guidance of British rule. The term “popular science” was unfamiliar at that time only because people in general had nothing to do with ‘science’. So far as Bengal is concerned we find only a handful of eminent scientists and writers to be actually inclined to express the content and concept of science in popular form in Bengali language. As a result, Akshay Kumar Dutta, Ramendrasundar Tribedi, Prafulla Chandra Roy, Jagdish Chandra Bose, Jagadananda Roy, Satyendra Nath Bose were in limelight for popular science writing in Bengali. They applied common sense and gave example from every day life to make their science writing more simple, gentle and lively to common mass. I have already said that in the period though some science lovers took their pen to ventilate their scientific thoughts in vernacular language, but the concept of popularization of science among common mass remained absent. After the Independence of India, Prof. Satyen Bose took initiatives to cater scientific thoughts in the mind of general people or getting in people involved in ‘popular science activities’ in a big way. If we look back in the past then we see in 1948 he founded Bangiya Bigyan Parishad with a mission to encourage regular culture of science in the language of the soil. Actually people’s science movements sprang up in different parts of the world during the 19th and 20th century: Eureka in Germany, science clubs in the Baku region of the Czarist Russia etc were some of them. The tidal force of science movement also sprinkled on the seashore of India. The Bangiya Bigyan Parishad in Bengal, the Assam Science Society in Assam, the Bigyan Prachar Sabha in Orissa,initiated by JBS Haldane, Sastra Sahitya Samithy of Kerala etc were some of the early ones. The Kerala Sastra Sahitya Parishad was properly formed in August 1962 with the limited objectives of functioning as a platform for science writers in Malayalam: “A Science Writers Forum”. But credit goes to the Kerala Sastra Sahitya parishad for coining the very term ‘PSM’- People’s Science Movement’ in the year 1978 for giving a name to a forth coming workshop involving ‘like minded’ organizations. During the 50s and the 60s, a movement gradually developed with the initiative of a section of educated class in West Bengal and Kerala, through encouragement in practice of reading and writing science, beyond academic periphery and also through model making, poster displaying, rendering health services to the community, through arranging lectures and debates on various science topics in a more or less amateurish way. Small science clubs were formed at both the urban and suburb areas. Thus a science club movement became quite popular in Bengal at that time. But the basic alienation of science from common people was still prevailing. Because only collecting and presenting information of technological achievements, highlighting fascinating functions of applied sciences and focusing on God-like magical efficacy of high-tech devices could not produce much impact on the consciousness of the mass as a whole. People in general did not get involved spontaneously in science or scientific activity. Not only so, after independence, one major problem that the state of West Bengal had to face was the problem of the rehabilitation of the refugees, who came from East Pakistan (presently Bangladesh). Naturally the priority of the state government was to resolve that problem. So the rehabilitation problem made science movement orphan in West Bengal just after independence. Thus the science movements in West Bengal did not get governmental patronage just after the independence.

Actually in 70s, people of India awakened from dormant condition. The scenario was now changing slowly; popular science now took a new look towards the people science movement. In West Bengal, this change or development was likely to have been related to revolutionary turmoil in radical political activities shaking the social, cultural and ideological frame of the society. We observed that all over India, people science movement simultaneously charged up due to the participation of the people of the different segments of the society. Novelists, artists, literature lovers, - the people belonging other than the world of science activated in several other Indian states and steered by non-political organizations like Kerala Shastra Shahitya Parishad in Kerala, Lokavigyan Sangathan in Maharashtra, Kishore Bharati in Madhya Pradesh. Automatically the science movement got kinetic energy to spread among the different segments of the society. The basic ideas of people science were propagated through some powerful slogans as: Science for the people, of the people, by the people, Science for social changes, science for better living, and science for emancipation. A new wave of movement bonded with science as the instrument, having deep social and political orientation, moving the common people emerged in West Bengal since the 70s.

Linguist Sri Sukumar Sen was curious to know about the use of the word 'Bigyan' in Bengali in the modern sense. Till 1860s the word 'Bigyan' has been used in Bengal in its etymological sense. Both 'Vidya' and 'Bigyan' have been used synonymously in different journals and magazines in Bengal till 60s of 19th century. The first Bengali book on science was published in May of 1817 when BankimChandra published 'Bigyan Rahashya' (the mystery of science). According to eminent scientist Gopal Chandra Bhattyacharya, children learn easily and aptly from practical experiences. Scientific communication enhances the curiosity regarding different things among students in a better way. Most of the developed countries utilize science communication as a mode of education that is almost absent in Indian scenario. Eminent Biologist Prof. J,B.M Halden asserts that science in its true sense is not applied for the development of Indian society.

During the post independence period in Bengal, students have not opted the science subjects out of love and interest rather as an instrument for academic score. Science education in schools, colleges and universities is limited within the pages of books rather than practical implementation. In 1985, held a workshop on Science Education in Bangalore where resolutions were initiated by UNESCO. Observation, inter-active session, project making, research, planning, field-work, measurement, using charts, experimental proof, information and communication were different processes mentioned by UNESCO of educating the students from primary level.

In 1957 and 58 in West Bengal, Radhika Baghchi, the science teacher of Scottish Church School engaged the students in practical works of science which was later named as Laboratory. Another science exhibition was organized in the premises of Scottish Church School in 1962. The headmaster of this school set up the institution named Science for Children in 1963.In 1967 amateur astronomers' association was established by St. Xaviers College. Birla museum (1959) had a major role in spreading scientific education beside traditional education.

In mid 60s Indian Radical Humanist Association set up by Manabendra Nath Roy also adopted an important role in popularizing science in Bengal. Several science clubs and institutions motivated the common mass to be more scientific even in their regular chores of life. Among these Howrah Bigyan Parishad (1968), Jadavpur Science Association (1971),Gobordanga Renaissance Institute (1973),Ashoknagar Bigyan Sangostha(1974), Chandannagar Science Club (1971), Paschimbanga Bigyan Karmi Sangostha (1975), The Science Association of Bengal (1977) are noteworthy.

Many people say that, the growths of Science & Technology after independence have increased the growth of Scientific Periodicals. It could not be said that after the independence in 1947 that type of progressive scientific age had come. It was true that the publication of the *Jnan O Bijnan* was started from 1948. But that was an exception. There was no other prominent science magazine before the sixties or seventies. In 1961, a tri-monthly magazine was published namely, *Manabman* (Human mind). It was a magazine of psychology, biology and social science. The main aim of this magazine was to develop the idea of a movement for a healthy mind both of the individual and the society. This magazine is continuing even today.

We have pointed out that the last part of 1960s and the whole of 1970s were the period of establishing different science clubs in West Bengal. Many people of the city and urban moffasils attracted to the science club movement. The aim of these science clubs was to make the young generation scientific in their attitude to life. To reach this goal, the science clubs organized some activities like model-making, sky-watching, science exhibition, science quiz, discussion, etc. To spread these ideas, these clubs published periodicals and pamphlets on science. So afterwards, these types of science clubs & different types of voluntary organisation published major science magazines. Now we will discuss about those magazine. The importance of mass media can never be ignored in Science communication. Both print media (Newspaper, Periodicals, Magazines etc.) and audio-visual media like Radio, Television, Internet etc. have major roles to play. The first science magazine after independence of India was 'Gyan O Bigyan' which was published by Bangiyo Bigyan Parishad in 1948. Later 'Manab Monn'(1961), published by Pavlov Institute, 'Swasthya Dipika'(1963), 'Prism'(1979), 'Lok-Bigyan'(1974) were the important science related magazine. In 70s 'Bikhyan' and 'Bigyan O Bigyan Karmi' were published parallelly with 'Manus', which had individual characteristics in science publications. During early and late 80s of 20th century several science magazines were published.

1948

***Jnan O Bijnan*:** A monthly periodical on science, published in January , 1948 under the auspices of 'Bagnio Bijnan Parishad' , Kolkata and the editorship of Prafulla Chandra Mitra. This Periodical has been playing a major role in popularizing science among Bengali knowing people. It is still continuing its publication.

1953

Homsikha: A monthly periodical on agriculture, published from Krishnanagar, Nadia under the editorship of Kaliprasad Basu.

1959

***Rogi-Chikitsa*:** A Bi-monthly periodical on homeopathy, published under the aegis of Sundar Homeo Sadan, Kolkata.

1960

***Ayurved Bijnan Patrika*:** A monthly periodical on Ayurveda, was published from Kolkata under the editorship of Kabiraj Krishna Kanti Roy . Apart from articles on ayurveda, few artices on general medicine and mathematics have also been covered.

1961

***Ayurved -Bharati*:** A multi lingual (Eng-Beng-Hindi-Sanskrit) quarterly journal of ayurveda and Indian culture, published as an organ of the ayurveda Bijnan Parishad, Kolkata under the editorship of Bagala Kumar Majumder.

***Manabman*:** A quarterly periodical, describe in Bengali as 'Manavjivan, Jivijnan o Samajvijnaner Adhunik Dhara Parichayak Trimasik Patrika, published under the aegis of 'Pavlopv Medical Research Centre' , Kolkata and the editorship of Dr. Dhirendranath Ganguly (Founder Editor).The periodical still continuing its publication.

1963

***Swasthya Dipika*:** A monthly periodical on health, published from Kolkata. The contributors in its periodical are mostly doctors by their professon. The periodical is still continuing its publication.

1964

***Sar Samachar*:** A quarterly periodical on agriculture, published under aegis of The Fertilizer Association of India', Eastern Region, Kolkta and the editorship of Sashanka Banerjee. The periodical is still continuing its publication.

1965

***Anka Bhavna*:** A quarterly periodical on mathematics, described in Bengali as 'Anka Bisayok Trimasik Patrika', published from the Kolkata, under the editorship of Kunal Kumar Majumder and Anandamohan Ghosh.

1966

***Bijnan Barta*:** A monthly periodical on Science, published from Kolkata under the editorship of Anjali Chowdhury.

1968

Two periodicals, which are described, bellow have been established in this year:

***Nabanna Barta*:** A monthly periodical on farming, published from Kolkata under the editorship of Jyotirmoy Ghosh.

***Sahitya O Vijnan*:** A quarterly review of literary and scientific writings, published under the auspices of 'Sahitya Ovijhan Parished' Sodepur, 24 pgs (N) and the editorship of Ramprasad Sarkar and Rajkumar Mukhopadhyay.

1971

In all, three periodicals, which are described bellow, took birth in this year:-

Esana**:** A quarterly periodical on Science, published under the auspices of Asansol 'Vijnan Parishad', Burduan and the editorship of Biswajit Mukherjee.

Sarir Barta**:** This quarterly periodical devoted to Physiology and allied subjects was published from Kolkata under the aegis of 'The Physiological Society of India'. The editorial work of this periodical was done by Debajyoti Das and Umasankar Sarkar.

Bijnan Bichitra**:** An organ of Murshidabad zilla Vijnan Parishad, Murshidabad, published under the editorship of Himangshu Sekhar Ghatak. The periodical used to have articles on popular Science.

1972
The year witnessed the birth of four periodical, which are described, bellow:

Banabani**:** A quarterly periodical on forest conservation and related fields. Published from Jalpaiguri under the editorship of Rukmini Mohan Bhattacharya

Chas-Bas**:** A monthly periodical on agriculture, published from Kolkata under the editorship of S. Biswas. The periodical is still continuing its publication.

***Dhnadha* :** A monthly periodical on Scientific Quiz especially on mathematics, published from Kolkata under the editorship of Biswanath Basu.

Gobordanga**:** A monthly periodical described in Bengali as 'Sambad Sahitya o Bijner Masik Patrika', 24pgs(n) under the editorship of Mani Dasgupta.

1973
***Chikitsa Barta* :** A fortnightly periodical on medicine, published from Kolkata.

1975
Five periodicals, which are described, bellow have been recognized in this year: -

Ganit Parikrama:A semi annual publication on mathematics , published under the aegis of 'Association for improvement of mathematics teaching, Kolkata and the editorship of A.mukherjee.

Homeo Keton**:** A monthly periodical, published under the auspicious of Homeopathic Medical Association of India, W.B, state branch , Kolkata and the editorship of Prabhat Kumar Bhattacharya. The periodical was renamed later as 'Homio Jyoti'.

Lokvijnan**:** The monthly periodical devoted to popular science, published under the auspices of 'Howrah Vijnan Parishad' and the editorship of Dr. Sushil Kumar Mukherjee.

Prakriti**:** A popular illustrated monthly compilation of article on natural history, nature study, life & environmental Science, published in Nov, 1975 from Kolkata under the editorship of Ajoy Home. Probably the periodical changed its title in 1980.

Vijnan Parikrama**:** The periodical devoted to science, published under the auspices of Konnagar Science Club. It was a half-yearly publication and was published from Konnagar, Hooghly, under the editorship of Nitai Chandra Porel.

1976
Jnan Bichitra**:** The monthly periodical devoted to popular science, published by 'Jnan Bichitra Prakashani' and the editorship of Debananda Dam.

1977
The year witnessed the birth of two periodical, which are described, bellow: -

Bijnan Manisha**:** A monthly periodical on science. It was published from Midnapore under the editorship of Jogen Debnath.

Bijnan o Bijnan Karmi**:** A bi-monthly periodical on Science, published from Kolkata under the editorship of Rabin Majumder . The periodical is still continuing now.

1978
Vijnan Sankriti**:** A monthly periodical on science & society, published from Kolkata Under the editorship of Soumen Guha.

1979

In all, two periodicals, which are described bellow, took birth in this year: -

***Beta*:** A quarterly Periodical on Science, published under the auspices of 'The Science Association of Bengal', Kolkata under the editorship of Subhabrata Roychoudhury.The periodical used to have both the Bengali and English version.

***Gabesana*:** A quarterly Periodical on Science, published from Kolkata under the editorship of Ashish Sengupta.

1980.

Six periodicals, which are described, bellow came of in this year:

***Homeo Samiksha*:** A monthly periodical on Homeopathy, published from Kolkata & Dhaka Under the editorship of Dilip Basu.

***Prakri Jnan*:** A popular illustrated bi-monthly journal on natural history, nature study, life & environment Science, published from Kolkata under the editorship of Ajoy Home.

***Utsa Manush*:** A quarterly Periodical on Science & Society, published from Kolkata under the editorship of Ashok Banerjee.

***Bijnani*:** A monthly periodical on Homeopathy, published from Kolkata & Dhaka Under the editorship of Sukla Ranjan Mrinda.

***Bijnan Pradip*:** A quarterly periodical devoted to Science, published under the aegis of 'The Science Association', Behala and the editorship of Shyamal Kumar Das.

***Bijnan Sahitya Manthan*:** A quarterly Periodical on Scientific literature, published from Kolkata under the editorship of Mukul Kanti Manna.

1981

The year witnessed the birth of four periodical, which are described, bellow:

***Bijnan Mela*:** A monthly periodical on science, described in Bengali as 'Chotoder Jnanya Bangla Bhasay Pratham Masik Bijnan Patrika, published from Kolkata under the auspices of 'The Science Association of Bengal'. In the beginning, the periodical was meant for the use of children and the published the editorship of Amit Chakraborty. Later the scope of periodical was widened to be suited by the readers of all ages.it is encouraging to know that the periodical is still continuing its publication, excepting a gap of eight years during 1984-1991.

***Kishor Jnan-Bijnan*:** A periodical devoted to science, targeted to reach to the yongers, published in april 1981 from Kolkata Under the editorship of Samarjit Kar, Rabin Bal, & Jayanta Dutta,. In the beginning the frequency of the periodical was not regular, but demands came to make it a regular monthly periodical. the periodical is still continuing its publication.

***Bijnan Club*:** A monthly Periodical on Science And Science Movement, published from Khantura Gobardanga, 24pgs(n), under the editorship of Dipak Kr. Dan.

***Bijnan Samachar* :** A fortnightly bi-lingual Science Club Magazine, published from Khantura, 24pgs(n), under the editorship of Dipak Kumar Dan.

1982

In all, three periodicals, which are described bellow, took birth in this year: -:

***Amader Bijnan Jagat*:** A quarterly Periodical on Science, published under the auspices of 'Paschimbanga Rajya Pustak Parshad', Kolkata & the editorship of Dibyendu Hota.

***Ganit Charcha*:** A quarterly Periodical on mathematics, published under the auspices of 'Paschimbanga Rajya Pustak Parshad', Kolkata & the editorship of Sibnath Chatterjee.

***LokBijnan*:** This quarterly periodical devoted to Science, society & culture, published from Kolkata under the aegis of 'Lokvijnan Prasar Samiti', Kashinagar ,24pgs(s) and the editorship of Asit Halder

1983

Three periodicals, which are described, bellow have been established in this year:

***Bislesan*:** A quarterly Periodical on Science published under the auspices of 'National Institute of Science & Culture', 24pgs(n), and the editorship of Manibhusan Bhattacharya & Bankim Dutta.

Machh: A monthly periodical on fishing published from Kolkata Under the editorship of S.K.Koner.

BijnanEsana: A monthly Periodical on Science, published under the auspices of 'Saktigarh Vidyapith', Siliguri,Jalpaiguri, and the editorship of Torun Chakraborty.

1984
The year witnessed the birth of eight periodicals, which are described below:

Anwesa: A monthly Periodical on Science, published by 'Vijnan Chetana' ,Kolkata under the editorship of Abhijit Lahiri.

Aryabhatya: A Periodical on Science, Society & Culture, under the auspices of 'Balichak Science Forum', Midnapore, under the editorship of Somnath Roy.

Health Home: A monthly Periodical on health, published under the auspices of 'Students Health Home', Kolkata, under the editorship of Lutful Alam.

Kanad: A monthly Periodical on Science, Society & culture, published from Kolkata under the editorship of Swapan Kumar Chakraborty.

Nabolok: A weekly Periodical on Science, published from Malda under the editorship of Arun Chakraborty.

Samaj o Bijnan **:** A monthly Periodical on Science movement, published under the aegis of 'Bangio Vijnan Parishad', kolkataand the editorship of Shyamsundar Dey.

Bijnan Niriksha: A monthly Periodical on Science, published from Siliguri, Jalpaiguri under the editorship of Jagadish Ghosh.

Yuga Bikshan: A quarterly Periodical on Science, Society & culture, published from 24pgs(n) under the editorship of Pradip Bose & Tapan Bose.

1985
Two periodicals, which are described, bellow have been recognized in this year**:**

Nutan Photon **:** A monthly Periodical on Photography& electronics, published from Kolkata under the editorship of Soumya Mitra & Debasish Banerjee.

Swasthya o Manush: A quarterly Periodical on health, published from Burdwan under the auspices of Sahid Sibsankar Sava Samity.

1986
In all, three periodicals, which are described bellow, took birth in this year: -

EJuger Elektronics: A monthly Periodical on electronics, published from Kolkata under the editorship of Debasish Banerjee.

Jana Bijnaner Isthahar: A bi-monthly Periodical on Science movement, published under the aegis of Paschim Banga Vijnan Mancha', Kolkata.

Ropan: A quarterly Periodical on Science& Literature, published from Kolkata under the editorship of Soumitra Ghosh.

1987
The year witnessed the birth of two periodicals, which are described below:

Adhunik Electronics: A monthly Periodical on electronics, published from Kolkata under the editorship of Debasish Banerjee.

Bijnan Manas: A quarterly Periodical on Science, published from Konnagar , hooghly under the editorship of Durjay Das & Dipak Bhattachrya.

1988
In all, three periodicals, which are described below, took birth in this year: -
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Mukhapatra Ganadarpan: A monthly Periodical on Scientific Awareness & Science movement, published from Kolkata under the editorship of Tripti Choudhuri.

Prism: A quarterly Periodical on Science, published under the aegis of 'Gobordanga Yuba Bijnan Sanstha',Khantura, 24pgs(n) and the editorship of Atanu Kumar Dey

Swasthya O Paribesh: A bi-monthly Periodical on health & environment, published under the editorship of Khetra Prashad Sen Sharma.

1989

The year witnessed the birth of four periodicals, which are described below:

Jana Swasthya: The periodical devoted to Helth, published as an organ of 'Jana swasthya Raksha Kendra', Ranaghat, Nadia under the editorship of Subhash Chatterjee.

Kishor Bijnani**:** A quarterly Periodical on Science, published under the aegis of Paschim Banga Bijnan Mancha',Kolkata, and the editorship of Shyamal Chakrabortty. The Periodical was Renamed in 1993 as Ejuger Kishor Bijnani'.

Neurabi**:** A quarterly Periodical on Science& Literature, published from Kolkata under the editorship of Kanailal Banerjee.

Bijnan o Samaj**:** A monthly Periodical on Science & Society, published under the aegis of 'Haldia Bijnan Parishad', Midnapore and the editorship of Debdash Mukherjee.

1990

Two periodicals, which are described, bellow have been established in this year**:**

Bijnan o Prajukta Mela**:** An annual publication featuring different events of scienc& technology fair, organized by Gobordanga Renaissance institute, Khantura, 24pgs(N).

Bijnan Prajukta o Pragati**:** A quarterly Periodical on Science & technology published under the support of 'Dept. of Science & Technology,Govt. of West Bengal, Bikash Bhavan, Kolkata'and the editorship of Sdabyasachi Guha & Sankar Chakaborty.

1991

Yuktibadi**:** A quarterly Periodical on Science& Rationalism, published from Kolkata.

1992

The year witnessed the birth of two periodicals, which are described below:

Arogya**:** A periodical devoted to Health & Medicine, published under the auspices of 'Social Health & Science Forum, Durgapore and the editorship of Bimal Das.

Quark**:** It is a bi-monthly periodical on Science, started publication under the editorship of Bijan Sarangi. The Perodical is Published from jhargram, Midnapore. The new series under the title 'Top Quark' appeared in February-March, 95. apart from Popular Science articles, essays an Socio-political and Socio-economic issues have also been covered in this periodical.

1993

In all, two periodicals, which are described bellow, took birth in this year: **-**

Prakritik Chikitsa**:** A quarterly Periodical on natural medicine, published under the support of 'Gobordanga Prakritik Chikitsa Mission', Khantura, 24pgs(N) and the editorship of Nirendralal Guha.

Swasthyer Sandhane**:** A forthnight periodical devoted to Health, published from Kolkata, under the editorship of Sristidhar Debnath..

1994

The year witnessed the birth of three periodicals, which are described bellow:

Prakriti**:** A quarterly Periodical on Science, nature & environment, published in Aug-Oct, 1994 under the aegis of 'Midnapore Science center' Midnapore under the editorship of Saibal Roy.

Prakriti**:** A bi-monthly Periodical on Science & Society, published under the editorship of Soumitra Banerjee.

Swasthya**:** A monthly Periodical on health, published from Kolkata.

1995

In all, two periodicals, which are described below, took birth in this year: **-**

Swasthya Bikash**:** A quarterly Periodical on health, published by 'Medical Service Service Centre', Kolkata.

Prakriti**:** A monthly Periodical on Science, published under the guidance'Break Throu Science Society' and the editorship of Subhasish Maity.

1996
Six periodicals, which are described, bellow have been established in this year**:**

Ebong Ki o Keno**:** A quarterly Periodical on popular Science, published under the aegis of 'Murshidabad Zila Bijnan Parishad', Murshidabad.

Ganit Anwesa**:** A quarterly bi-lingual (Beng-Eng) Periodical on Mathamatics, published from Baruipur, 24pgs(s) under the editorship of Abdul Halim Sekh.

Krishi Barta**:** A quarterly Periodical on Agriculture, published under the aegis of Vidhan Chandra Krishi Viswabidyalaya,Kalyani, Nadia, and the editorship of Dibyendu Sen.

Prayukti**:** A monthly Periodical on engiaring & technology, published by Ramkrishna Mission Shilpa Mandir', Kolkata & sponsored by Ministry of Human resource Development, Govt. of India, under the editorship of Binod B. Pal.

Prakriti O Bishwa**:** A quarterly Periodical on Science, nature & environment, published under the aegis of ' Science center Gol Kuachak' ,Midnapore under the editorship of Saibal Roy.

Sabuj Barta**:** A quarterly Periodical on Science & Nature, published under the aegis of 'Jadavpur Vibek Nagar Nature Lovers Association', Kolkata and the editorship of Tarak Nath Bhattacharya.

1997
The year witnessed the birth of six periodicals, which are described, bellow:

Computer: Thatya o Prayukti- A monthly Periodical on Computer Science & information technology, published from Kolkata the editorship of Indira Bhattacharya.

Ekush Sataker Yuktibadi**:** A bi-monthly Periodical on Science, published under the support of 'Bharatiya Bijnan o Juktibadi Samity' , Kolkata and the editorship of Debasish Bhattachrya

Gana Bijnan Barta: The monthly periodical devoted to Science movement 'published from Kolkata under the editorship of Subhash Chatterjee.

Gana Vijnan Charcha**:** A Popular Science magazine(5 issues in a year) published under the aegis of 'Jhargram bijnan Parishad', Midnapore .

Masik Computer o Electronic Jagat**:** A monthly Periodical on Computer Science, electronics & information technology, published from Kolkata under the editorship of Debasish Banerjee.

Prani Palaner Darkari Katha**:** A monthly Periodical on Vetenary Science, published from Kolkata under the editorship of PradipKumar Das.

Chaser Katha**:** A quarterly Periodical on Agriculture, published under the aegis of development Research Communication & Services Centre', Kolkata and the editorship of Subrata Kundu.

1998
In all, six periodicals, which are described below, took birth in this year: -

Computer & Telecon: Today & Tomorrow**:** A multi-lingual(Beng-Eng-Hindi) Periodical on Computer Science & information technology, published from Kolkata under the editorship of S.K.Pandey.

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Ekuush Sataker Bijnan**:** A Periodical on Science, published under the aegis of 'Bjnan o Sanskriti Gabeshana Kendra, Kolkata under the editorship of Amitava Dey.

Kishor Yuktubadi**:** A bi-monthly Periodical on Science & science Awareness, published by 'Bharatiya Bijnan o Yuktibadi Samity, Kolkata, under the editorship of Rajesh Dutta & Debkumar Halder.

Medical World**:** A weekly Periodical on Medical Science, published fromKolkata, under the editorship of Jayanta Chatterjee.

Sustha**:** A monthly Periodical on Health, published by Aajkal, Kolkata, under the editorship of Ashok Dasgupta.

Swasthya O Chikitsa**:** An annual (1st july, every year) Periodical on Health, published by

Ganashaktil, Kolkata, under the editorship of Anil Biswas.

1999

Two periodicals, which are described, bellow have been established in this year**:**

Spandan**:** A half yearlyPeriodical on Science, published from Raiganj, under the editorship of Utpal Dutta & Kaushik Dutta.

Tabe Ki Khabo**:** A Periodical on Science, published under the aegis of 'Bijnan Mansikata Vikash Kendra, Kalyan garh, 24pgs(N), and the editorship of Bankim Chakrabortty.

2000

The year witnessed the birth of three periodicals, which are described below:

Batayan**:** A Periodical on Science,society, & culture, published from Kolkata under the editorship of Subhash Chandra Sarkhel..

Chayan**:** A Periodical on folk and traditional science& technology, published under the aegis of Nodal Research Centre, Kolkata, and the editorship of Amitava Sen.

Prithibir Disha**:** A monthly Periodical on Science for Children, published from Kolkata, under the editorship of Malabi Gupta.

During the span of the time the periodicals appeared mostly under the sponsorship of Science Clubs & Association of Local & state levels. Few have been under the government and Individual initiatives. From the Available information it has been found that the periodicals are of weekly, fortnightly, monthly, bi-monthly, quarterly, semi annual, half yearly, annual frequencies. But mostly they are of either monthly or quarterly besides the short-lived periodicals; long lived-periodicals have also been identified in this era. Though, some of these periodicals have ceased their publications, some are still being published. For example Jnan O Bijnan, Manabman, Sarsamachar, Chas Bas, Swasthya Dipika,Vijnan o Vijnan Karmi, Vijnan Mela, Kishor Jnan Bijnan etc. are still living and have been published more than two decades. Again, most of the periodicals have been published exclusively in Bengali, Some Are bi – lingual or multi-lingual. One more striking feature is that through some of the periodicals have been operated under the same title –their frequency, place 7 year of publication, publishers, editor etc are quite different., Lokbijnan(monthly) reported in 1975, was published by Howrah Bijnan Parishad under the editorship of Sushil Kumar Mukherjee and Lokbijnan (quarterly) reported in 1982, was published by Lokbijnan Bijnan Parsar Samity under editorship of Asit Halder are relevant to be mentioned here. Again Prakriti (quarterly) reported in 1994 was published by Midnapore Science Centre under the editorship of Shaibal Roy & Prakriti (bi-monthly) reported in 1994 was published Kolkata under the editorship of Soumitra Banerjeeare also worthy to be mentioned here.

Radio is not only the source of entertainment but also a medium for non-formal education. Talking about radio in Bengal essentially refers to Akashbani, Kolkata. The science section of All India Radio, Kolkata ushered its day in mid 1976.Dr. Amit Chakroborty was designated as the Science Officer with two assistants namely, Dr. Ashok Bandyopadhyay and Krishna Ghosal. On the occasion of Scientist Satyendranath Bose’s Birthday the science section announced different programmes on science. Kolkata station of All India Radio started a regular programme on science every Thursday at 8p.m.Programmes like Bijyan Jigyasa,Anwesha used to be broadcast in this particular segment.It is noteworthy that Anwesha is broadcast on Saturday instead of Thursday on Kolkata ‘A’ channel from 8.00 to 8.30 p.m.In the mid 80s India Government took initiatives to communicate science in a better way and thus formed Jatiya Bijyan O Projukti Prachar Parishad. This parishad produced a series of science programmes, beginning in 1989 where inter-personal communication and science communication were simultaneously emphasized. The FM section of All India Radio,Kolkata broadcast science programmes on every first, third and fifth Friday of Every month from 10 to 12 o’clock since 1994.

Among the Bengali newspapers there are three, which regularly publish a weekly special page on Science. ‘Kalantar’, which was previously known as ‘Swadhinata’, publishes ‘Prokiti O Manus’ every Monday; ‘Bartaman’ publishes the science page titled ‘Bigyan Bichitra’ on Tuesday regularly. ‘Bigyaner Khabor” –of ‘Ganashakti’ which comes out on each Monday definitely flags the theme of science popularization. Besides 'Dainik Statesman' affords half-page on every Thursday named 'Anubikhyan' for science news. Other newspapers though not having a special page on science have importance in science communication.

As an electronic media Doordarshan and other private TV channels serve a little bit for science communication in comparison with radio. Programmes like 'Bigyan Prosonge','Swasthya Jigyasa','Bigyan Quiz', and agricultural issues used to be telecast on Doordarshan. Programmes related to health and hygiene is also telecast on Doordarshan for e.g. 'Hallo Doctor'. Other private Television channels telecast a very little bit science based programmes; rather they have been interested to telecast programmes on occult, astrology and also serials instead of any science programme due to TRP factor.

After the independence, new born India government felt that science is necessary for the over all development of the common people and this thinking was recognized by framing the directive principles of our constitution. Article 51(A) (h) says that it is the duty of all citizens "to develop scientific temper, humanism and the spirit of inquiry and reform." To fulfill this duty the scientific knowledge should be disseminated. More over, the Right to information Act which is enacted on June15, 2005, speaks of the citizens right to get information which has been defined as material in any form, including records, documents, memos, e-mails, opinions, advices, press releases, circulars, orders, logbooks, contracts, reports, papers, samples, models, data material held in any electronic form and information relating to any private body which can be accessed by a public authority under any other law for the time being in force. So science news is easily access able for the common people who interested in science. To grow awareness in the mind of the people the schools are the starting point. Mere cramming of facts and theories without laboratory work was a dull affair and the students could not develop a genuine interest for the subject. The Government of West Bengal accepted the truth in its official publication that science is being taught but the students cannot grasp it. To attract the common people about the science and technology a science museum is to be needed- this fact was realized by the chief minister of West Bengal of that time, Dr. Bidhan Chandra Roy. A science museum, the first of its kind in India was set up in nowhere else but West Bengal in the year of 1959. Both the Union and the State governments took up this project under the initiative of the Chief Minister Bidhan Chandra Roy. Ultimately, on 2nd May, 1959 the museum was inaugurated by Humayun Kabir, the Union minister for scientific research and cultural affairs. Name of the museum was given the Birla Industrial and Technological Museum that is popularly known as B.I.T.M. It had brought up a new mode of science education for the common mass. It was non-formal in character but immensely effective in function. After its emergence, B.I.T.M played a major role in the multi-faceted working domain of science movement. It showed that science could be popularized as a way of info-tainment. It had asked the common people and the students to enjoy and explore the fun and excitement of the world of science.

Meanwhile, in the year of 1958, an important policy decision was announced on the part of the Union Government. That was the Scientific Policy Resolution, declared in the Loksabha on 4th March 1958, which was emphasized on the development of scientific temper through the use of scientific approach and scientific methods for achieving the goal of prosperity. In 1956 the Union Government had taken the matter seriously and it was first seen that Scientific Advisory Committee to the Cabinet (SACC) was formed under the leadership of Dr. Homi Jahangir Bhaba. After working ten years, the committee was renamed as the Committee on Science and Technology (COST). In 1971 it was transformed further into the National Committee on Science and Technology (N.C.S.T) and it was again reformed in 1975. The scientific organizations in India could be divided into two parts – Task coordinator body and Task implementation body. The National Council for Science and Technology communication (N.C.S.T.C) or Rastriya Vigyan Evam Prodyogiki Sanchar Parishad under the department of Science and Technology, Government of India being came into existence in 1982, to communicate scientific knowledge and to inculcate scientific and technological temper among masses. In 1990, India Government was taken a new programme, namely- Mass Action for National Regeneration (MANAR). It was said that Bharat Jan Gyan Vigyan Jatha (B.J.G.V.J) would be a nation wide mobilization leading to MANAR as its ultimate goal. Apart from N.C.S.T.C in 1989, as an autonomous registered society, the department of science and technology to take up large-scale science popularization projects established another governmental organization- Vigyan Prasar.

Laterally the Government of West Bengal took initiatives to popularization science in the mid of 70s. On 14th October 1974 Satyendranath Basu Bijyan Sangrahashala O Hate-Kalame Kendra (Satyendranath Basu Science Museum and Experiment Centre) was established in Bangiya Bigyan Parishad. Later the change of political ambience in West Bengal some how affected the science movement. At that time, there was no science department in West Bengal. As a neglected sector, West Bengal Science and Technology Committee under the Development and Planning Department had monitored scientific works. Finally in March 1988, after the amendment of the Rules of Business of the state government, the Science and Technology Department was created and in June 1988 the department was started it’s functioning. Two months later, an advisory council was formed as the State Council for Science and Technology under the scheme (“Assistance for development of State Council fir Science and Technology”) of the Sixth five-year plan. The main objective behind the formation of this state council was to set a focal point for the formulation, planning, coordination and enhancement of science and technology activities within their respective states. But problem was that though it was an advisory body without any autonomous character or executive power, it had no option to make any financial decisions to execute the scientific and technological schemes. Both the science and technology department and council had very much depended on outsourcing of money. Even they did not disburse the funds offering by the government of India. Under this circumstances the state council of science and technology in its 5th general meeting held on 10th December1990 under the chairman ship of the chief minister, took the decision to boost up the council by granting some sort of financial autonomy for effective execution of the time-bounded schemes. Accordingly, following the guidelines of the West Bengal Societies Registration Act a draft memorandum for the West Bengal State Council for Science and Technology had been prepared and finally, the council was registered on 14th October1993. Then a new dimension came into the field of science and technology popularization in West Bengal. The very next year the state council arranged the West Bengal State science and technology congress, which was very important for the science movements. In this congress, scholars got the opportunity to present their research work in the vernacular. The work of the science department also reflected the eagerness of the state government to do the work of science popularization with the various active organizations of the state in a collaborative manner. So in 1990, West Bengal Science and Technology department observed the National Science Day jointly with the eighty-six science clubs of West Bengal. In the budding condition, Paschimbanga Bijnan Mancha arranged its first state conference on 19th and 20th March, where in the presidential address Mr. Shankar Chakraborty said that the role of Science and Technology Department of Government of West Bengal was very praiseworthy in its endeavor to solve the scientific and technological problems of the rural community. Another remarkable step of the Government of West Bengal is starting the two science related award. One is the Meghnad award and another is Satyendra award. Since 1995 Meghnad award had given to recognize the role of science organizations in directing the scientific activities for the people. On the other hand Satyendra award is exclusively for the writer who had written a particular book on science for the adolescent. Thus the both union and state Government had given patronage and had started to play the role of a collaborator in the field of science popularization in West Bengal.

Science is written records of man’s understanding of nature and that is why to make science, technology and society synchronize, we have to make science more meaningful and technology more human-oriented. Science popularization means the transmission of scientific knowledge from scientists to the lay public for purposes of rational thinking. India Government has already declared year 2004 as the ‘Year of Science Awareness’, when the importance of science communication cannot be ignored. It is regretting that simultaneously occult, astrology is getting importance. Religious education and astrology are sometimes included within the syllabus. But people who are really progressive definitely intend to teach the present generation utilizing the scientific methodology of communication. Science is the only one, which can remove all the barriers logically and practically.

But unfortunately we still find in the state like West Bengal various types of superstitions, pseudoscience and deep-rooted religious dogma still prevailing in the society. So Pulse Polio campaign was not successful in various parts of the state due to lack of science awareness. Illiteracy, poverty and lack of science awareness campaign according to need are the main hindrance of science movements in Bengal. Science has developed while scientific bend of mind lags far behind. Science therefore has only a limited influence on the society. Though science communication has developed but this is not enough according to big population. Finally the science popularization movement has taken acceleration in the mid of 70s in West Bengal. So we lost many times after independence. But better late than never. During '80 onwards several pro-people science groups came up in action in different districts of Bengal. It is observed that the science movement is mainly concentrating in urban areas, more specifically in Kolkata. Though many science groups (like Drug Action Forum, Bigyan O Bigyankarmi, Manas, Ganabigyan Samanyay Kendra, Ganadarpan, Norman Bethune Janasasthya Andolan, Bharatiyo Bigyan O Juktibadi Samity, Canning Juktibadi Sangskritik Sangstha, Paschimbanga Vigyan Mancha etc.) came into existence to penetrate in the villages and gaining lot of supports from the local mass. Impact of science movement, science communication on society might be low at present but the dream is high. In the context of present darkness in social justice, awareness and equality, one can find the glimmer of dawn- a new hope ahead through this People Science Movement in West Bengal.

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Scientists and Popular Science Books–The role of Scientists in Science Popularization

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Abstract. It is a social responsibility for scientists to popularize scientific knowledge in the public. Books are one kind of media to popularize science, and scientists trust and know it very well. So far, books have been playing an important role on helping scientists to promote the pubic understanding of science. In the paper, at first, the author reviews and analyses the position of the popular science books, the role of scientists in publishing popular science books as well as the mainly collaborating way between scientists and publishers in science communication in China. The author points out that under the buffet of new media and high technology of science communication, scientists should pay more attention to publication of popular science we called as a traditional media. Facing ever-increasing interests and demands to scientific knowledge from the public, we should strengthen the interaction and contacts between the public and scientists through the media of popular science books.

In the paper, the author provides us with some cases and practical examples to explain no matter whether scientists are authors, recommenders or leading characters in the popular science books, they can produce or form favorable models of science communication through which readers are close to science and understand science. Finally more and more people are attracted by glamour of science. In the meantime, the author emphasizes that comparing with male scientists, when taking up science education or work on science popularization, female scientists will have a distinctive advantage because they have both the meticulously rational thinking and the character of maternal love with mildness and patience.

Climate Change as Stop-Motion Films

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Abstract. This paper is about how to make upper secondary school students communicate climate change issues by developing stop-motion films in a cross-disciplinary teaching environment involving the subjects biology, geography, social science, Danish and arts. Inspired directly by the 'Images of Science' session and the Copenhagen Challenge at the PCST 9-conference in Copenhagen/Malmø, LIFE The Faculty of Life Sciences at University of Copenhagen initiated a project about how to make young people communicate climate change issues using popular media.

Two upper secondary school classes worked with climate change for a week. They met researchers working with bio fuel and CO_2 credits, they worked with the topics in geography and biology, learned about discourse analysis in social science, comic movies as a genre in Danish and arts and ultimately produced short stop-motion films about climate change. The films were all uploaded on YouTube.

The project was carried out in cooperation with Sankt Annae Upper Secondary School in Copenhagen–a secondary school renowned for giving students an opportunity to develop their skills both academically and in the creative (especially) musical arts. The project was supported financially by the Danish Ministry of Education and was followed up by detailed didactical descriptions (on the Internet) in order to make it possible for other teachers to conduct similar cross-disciplinary projects linking science and the arts. Following are some links to film examples:

http://www.youtube.com/watch?v=LXTXVay4JGg (Danish speak, will be re-recorded in English)
http://www.youtube.com/watch?v=STnmuOXaIjM
More: http://www.sag.dk/sag-nyt/index.php?id=268

Impact on Policy through Science Journalism–Evaluating SjCOOP, a Capacity Building Programme for Journalists in Africa and the Middle East

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Abstract. The SjCOOP-project builds the capacity of science journalists in Africa and the Middle East. It establishes peer-to-peer mentoring-relationships and also supports new national and regional associations of science journalists. In its first phase, between 2006 and 2009, the project yielded numerous outcomes which indicate that a push in the professionalization of science journalism has been achieved. The evaluation of the second phase of SjCOOP now lays an additional focus: It aims at assessing the impact which specific articles or broadcasts may have on the public agenda and on governments' decisions and policies.

Keywords: Media development, Journalism impact, Mentoring, Outcome mapping, Agenda setting

Introduction

Capacity building programs for better science journalism in developing countries have in the past been generally driven by governments concerned with science literacy or institutions aiming at making sure journalists would transmit the right information regarding specific issues like AIDS, bird flu, climate change, GMOs, and countless other important issues. The means used have then been limited to either academic courses at universities or to short term training activities. In most of these activities students or journalists are trained for a short period of time on how to report on environment, health, technology and science. Evaluation of these activities and their outcomes are usually very limited, if at all existent and journalists are usually passive recipients of the training or information.

In this paper the structure and evaluation framework of SjCOOP ("science journalism cooperation") is described, a long-term support-programme for science journalists in Africa and the Arab World. An initiative by the World Federation of Science Journalists (WFSJ) this project is managed from its headquarters in Canada in close cooperation with regional coordinators in Africa and the Arab World. It is funded by major international donor organisations: the British Department for International Development (DfID), the Canadian International Development Research Center (IDRC), the Swedish International Development Agency and the Dutch Ministry of Foreign Affairs.

Science journalists, in general, face a number of professional difficulties inside as well as outside their media organisations (Bauer/Howard 2009, Lublinski 2011). The starting point of SjCOOP is the idea that science journalists in general are willing to help, cooperate with, and support their peers worldwide (Fleury 2008). The aim of SjCOOP is to build an international network of colleagues and to enable a critical mass of science journalists overcome their problems, advance their careers, take the initiative in their own training, and take their stand in developing countries.

In order to achieve this goal a number of activities are carried out, including dedicated monitoring and evaluation. The objective here is to build a learning culture into the project and also to understand certain change-processes in the newsrooms and beyond.

SjCOOP has run a first phase from 2006 and 2009. A second phase of the project (from 2010 to 2012) has just begun. In the following past achievements as well as new plans are discussed.

Mentoring Science Journalists

Through the SjCOOP-project 15 experienced science journalists (mentors) are linked to 60 aspiring science journalists (mentees). While all the mentees come from developing countries, half of the participating mentors come from developed countries. All participants are divided into three regional groups: anglophone Africa, francophone Africa and the Arab World. Each group is led by a regional coordinator, coming from Nigeria, Cameroon and Lebanon respectively.

In peer-to-peer relationships each mentor-mentee-pair develops individualized plans of action for support through coaching and consultancy. Mentor and mentee discuss, face-to-face or by electronic communication, the contents of manuscripts the mentee has written. They also exchange on research strategies, questions of career advancement, networking, etc.

These relationships are supported by a number of additional activities and tools: once a year face-to-face meetings with trainings and field trips are offered. Web-based resources and networking-opportunities are supplied: a dedicated online platform for exchanges among the participants and discussion groups, and press conferences organized on skype. Also the building of international teams of reporters is encouraged: joint research and publication projects are carried out on selected topics.

Another important resource is the world’s first Online Course in Science Journalism (WFSJ 2008) which has so far been translated to seven languages. It covers major practical and conceptual issues in science journalism, such as how to find and research stories, exposing false claims, how to pitch to an editor, turning crisis reporting to advantage and so forth – topics that are relevant to beginners in journalism as well as more experienced reporters and editors in all regions of the world. The authors of the course are journalists from many different countries. A large number of mentors and mentees of the SjCOOP project are involved in developing and improving the course (Clayton/Lublinski 2008).

Overall the SjCOOP project supports journalists while they stay in their normal working-environment: They keep their jobs in their newsroom, carrying out their regular duties while benefitting from the support provided by the project. Instead of being taught in an artificial training setting often by outsiders to the profession, SjCOOP-participants are helped to grow on their job by colleagues. Improving one's skills becomes part of the professional attitude, a sine qua non for a successful career in science journalism.

Some SjCOOP Mentoring Results

During the first three-year phase of this project numerous outcomes have been achieved. Among them are 12 new science beats that have been established by the participants (science desks, science pages or special science broadcasts on TV or radio, and a new pan-African science magazine using mentees as correspondents). 22 mentees have won a total of 44 awards (prizes or scholarships), among them three scholarships for the prestigious Knight Science Journalism Fellowship at the Massachusetts Institute of Technology. 15 mentees have been promoted to higher positions in their own media, 18 have started to freelance internationally (WFSJ 2009).

Association Building

As a second core activity the SjCOOP project helps African and Arab journalists in founding new national and regional associations of science journalists. Consultancy is given for setting up constitutions, fundraising and partnering with long-established associations of science journalists in rich countries. In the course of the first phase of SjCOOP eight new associations were formed and have all proven to be active in supporting science journalists.

SjCOOP supported associations through the partnering, or “twinning”, of newly established science journalists’ associations with long-established ones. One example is the twinning between the Arab Science Journalists Association which was established in December 2006–with the National Association of Science Writers in the United States, which was established in 1936. As a result of this cooperation the 7th World Conference of Science Journalists will be held between 27th and 29th June 2011 in Cairo, Egypt.

Another example is the twinning of Cameroon’s science journalists’ association with France’s Association des journalistes scientifiques de la presse d'information. In addition, Kenya has been twinned with the Canadian Science Writers' Association, Nigeria with Germany’s Science Journalists' Association, and Uganda with the Association of British Science Writers.

In its second phase SjCOOP supports these new associations by providing means for the organization of select activities such as training workshops and attending conferences.

Evaluation with “Outcome Mapping”

A development project of the size of SjCOOP needs a dedicated framework for evaluation and learning. In the first phase of the project, Outcome Mapping has been used: an integrated method of planning, monitoring and evaluation which has been specifically designed for capacity building in complex developmental settings. It provides for a participatory process that builds a culture of organizational learning and evaluative thinking into a project (Earl/Carden/Smutylo 2001).

The main focus of Outcome Mapping is to measure changes in the behaviour of people and organisations with which a development initiative works with most closely. So according to this approach it is not enough to create information, disseminate it and raise awareness. It is the action people take that counts; in other words behavioural change that can be observed through a monitoring and evaluation process. These measured "outcomes" of the project's partners are considered to be a guiding "map" in the complex, changing and at least partially unknown territory the project team chooses to be active in.

In the case of SjCOOP, the project team works with three groups of beneficiaries ("boundary partners"): the mentors, the mentees and the national associations of science journalists. Long lists of actions or behavioural changes ("progress markers") were suggested, revised and adapted several times. In the case of the mentees, for example, the project works with some 20 "progress markers", which include a wide range of outcomes indicating that a certain change process is actually happening, e.g. "finding a way to regularly access the internet", "improving their writing skills with the help of the mentor", "applying for journalism awards", "creating science beats or new science media".

A selection of these "progress markers" was being monitored during the first phase using a number of different methods: mentees were interviewed on the phone, mentors filled in questionnaires regularly on their work and the progress of their mentees. The content of the mentee's articles/broadcasts were evaluated by external journalists. Also editors-in-chief were interviewed by evaluators as well as the scientists or experts the mentees had interacted with. It is through the combination of these methods that the project team is able to understand data, learn where the difficulties of the project are and take decisions based on insights from different angles (El-Awady/Lublinski 2008).

Evaluation with "Logframes"

The evaluation framework of the second three-year phase of SjCOOP, which started in 2010, is now combining the methodologies of "Outcome Mapping" and "Logframe Analysis". The idea here is to use and maintain the processes and results of the first phase while at the same time better meeting the donors' requirements for rigor and accountability in evaluation. It turned out that having gone through a creative and flexible first phase was very useful for defining a complex logical framework matrix. Here the theory of change is described by a set of levels that describe possible outcomes and impacts of the intervention on different levels. Having built the project with Outcome Mapping made it easy to find meaningful logframe indicators to be measured in the second phase.

In addition to this new framework some new Outcome Mapping elements are developed: Each mentor-mentee pair is encouraged to develop their customized mentoring plan by defining individual "progress markers". Also for the new associations of science journalists new, individualized plans of action and outcomes are being set up.

Overall this new synthesized framework brings the opportunity of evaluating the process as well as the results of SjCOOP in a participatory, flexible and yet scientific way, based on a testable theory of change, as described theoretically by Roduner/Schläppi/Egli (2008).

New monitoring activities which are carried out in the second phase include (on top of the ones described above in section 5.): analysis of the opportunities for science journalism in the media the mentees work, assessment of the professional level of mentors and mentees as well as gender mainstreaming.

On top of this, two new evaluation activities are under way which are especially demanding: The quality of the mentee's articles and broadcasts will be assessed through scientific content analysis and the impact of specific stories/articles on the public agenda and on the change of policies will be assessed in a limited number of cases. These two elements require their own communication research projects which will be outlined below.

Measuring journalistic quality

In the second phase of SjCOOP the articles and broadcasts produced by the mentees will be evaluated at various times in the course of the project. This assessment should reveal progress in terms of journalistic quality. In order to discover reasons for this progress, data on interfering variables (e.g. training, the editorial environment and structure of the newsroom, media freedom) will be compiled.

The judgements on the journalistic quality will me made on the basis of quantitative and qualitative content analysis of manuscripts, a method previously established through the evaluation of other media development projects (Spurk/Keel/Lopata 2010). In order to account for the counterfactual also manuscripts written by journalists who had applied to be SjCOOP-mentees but have not been selected will be analyzed also.

As a basis for this evaluation a quality criteria catalogue has been established at the outset of the second phase of the project. The idea here is to decompose the general notion of quality into smaller units, i.e. quality criteria. Although many quality criteria may be overlapping or differ according to media genre, target group or editorial preferences there are some core fundamental quality criteria for journalism that can be agreed upon.

The quality catalogue for the evaluation of SjCOOP has been assembled from three sources: 1. guide-lined interviews with the mentors, 2. an analysis of the Online Course in Science Journalism and, 3. a review of the literature on quality in journalism and science journalism (Blum/Knudson 1997, Arnold 2008, Hettwer et al. 2008, Brake/Weitkamp 2010, to mention only a few authors here.).

The interviews yielded a good consensus among the mentors on the following criteria for journalistic quality (which were in accordance with the online course and can also be found in the literature): diversity of sources, diversity of viewpoints, adding background to a story, correctness of information, citizens as main obligation for reporters, audience adequate writing style and the use of other ‘transformation’ techniques to improve the comprehensibility of an article or broadcast. This catalogue has been agreed upon by the mentors as well as the SjCOOP-staff and will be used as the basis for the evaluations to be carried out in the course of the project.

Impact Stories

In the first phase of SjCOOP we saw the production of a small number of journalistic stories in news media which led to societal dialogue and in some cases government decisions in developing countries. Three examples shall be given here:

A mentee from Cote d'Ivoire published a dossier on the reintegration of people who have been displaced by war and lack psychological support. In doing so he stirred discussions in his country, the ministry of war victims contacted him to let him know they were lacking money to carry out the plan of action they had originally intended to follow.

Another mentee's article published in a major daily newspaper in Uganda focused on expired anti-retroviral (ARV) drugs distributed by government stores and leading to death. As a consequence of this journalist's report the director of the ARV distribution scheme lost his job.

A mentee from Cameroon led a team of journalists that highlighted the lack of progress in extracting the carbon dioxide gas accumulating in infamous Lake Nyos. The reporting was instrumental in triggering the implementation of remedial measures.

So far these and other cases have provided anecdotal evidence for societal change processes in which science journalists played an important role. Yet, they have not been studied or evaluated in detail. These results were unintended outcomes: the project, in its first phase, was not directly aiming at achieving them.

In its second phase, the SjCOOP project will lay a main focus on these «impact stories» both in its programme management as well as in the accompanying evaluation and research activities. In a few selected cases we will try to understand the influence certain science journalism stories have on public discussions, attitudes of the general public and the reactions by public policy in terms of policy change.

The anecdotal cases reported in the first phase of SjCOOP nicely fit in the three varieties of policy effects identified by Protess (1991): deliberative results (debate on war victims), individualistic results (firing of AIDS drug officer), and substantive reforms (lake Nyos). Further research is needed to add to and describe these cases in detail.

Conclusions

A true push in the professionalization of science journalists in Africa and the Arab World has been achieved through the first phase of the SjCOOP project. The blending of different activities on different levels (face-to-face meetings, individual mentoring, reporting teams, association building, use of dedicated tools on the internet) has led to numerous outcomes that show the progress of the projects' participants and science journalism in general. This progress is being achieved while the supported journalists stay on their job: they are trained «in situ».

This project can also serve as an example for the synthesis of the Outcome Mapping and Logframe Analysis approaches for evaluation. In order to plan, monitor and evaluate this complex capacity-building project a combination of management and evaluation tools for development as well as communication research is needed. This holds especially true when it comes to studying the impact some dedicated science journalistic stories may have. The results, we hope, may lead to new approaches in evaluations of media development projects as well as research uptake programmes.

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Daisy Communication of Scientific Fact through Advertisements in Indian Media

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Abstract: Media is playing vital role in education, awareness and entertainment, even idiot box is also enjoying the warmth of communication in contemporary communication arena. TV screen is capturing minds and mood of the audiences, in the manner that each and every pattern of our life is being affected by the media interface. In this media progressive world the communication about science and scientific fact are being adopted by the audiences in the manner they are being shown on the screen. This paper will dissect and analyze the science communication through advertisements which are creating a daisy information environment. If media can create a wave of positive communication then a daisy communication can harm audiences as well. In this paper it has been analyzed that the science communication through advertisements has given them a platform to accesses new information about scientific facts. Now it is responsibility of a communicator, that the information which is being circulated through advertisements should not create any miss information are any dilemma in the minds of audiences. Advertising communication is the key player in the field of mind & Mood management. This paper will give a view of acceptability of communication approach through the promotional communication and also give the acceptability of the scientific facts and their impediments on the societies. It has been raveled that so many advertisements of the contemporary media reflects so many medical facts, although they are awaking common man about science but not in the proper prospective. Audiences are being fool with facts given in the communication. They are using medicines without prescription of a doctor. So many shampoos and FMCG are being used in the impression of scientific fact. Such communications are not confined for the Medicines and cosmetics but also for the lubricants, child food stuff, pet's food, automobiles etc are being sold with the help of science. Yes it is true that, such communications are making audiences aware about science and science communication but on which cost. On the unsatisfactory performance of the product in the mind set of the audiences. It has been revealed that if audiences will be annoyed by such daisy communications, science will become a hard nut for them and again communication about same will be a tough task. In fact Indian audiences are not so much matured that they can analyze the wrong and right prospective of the communication and the impact of the same. So, the communication especially science communication in advertisements are very daisy and rather than communicating a proper image of science, companies are cheating their audiences in the name of science. No doubt this approach is affecting the real media world as well as the science communication stream. This paper will not give only the picture of daisy science communication in advertisements but also suggest a way to meet with the consequences of the communication.

Keywords: Communication, Advertisments, Audiences, Daisy communication

Saúde, Educação, Cidadania, Jornalismo Cientifico, Popularização da Ciência

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Abstract. Neste trabalho busca-se relatar a experiência de pouco mais de dois anos do programa de rádio Saúde com Ciência, da Universidade Federal de Minas Gerais. Sob o *slogan* "A informação a serviço da qualidade de vida", adotou-se o estilo jornalístico como forma de expor o conhecimento científico sobre saúde produzido na universidade pública diretamente ao cidadão comum. O objetivo esperado é que desta forma este público tenha acesso a informações úteis, apresentadas de uma forma curiosa e bem humorada, com vocabulário simples, e que tratem de questões por vezes complexas relativas à promoção da saúde, prevenção de doenças, hábitos, direitos, normas de funcionamento do Sistema Público de Saúde, deveres, cidadania, conceitos e comportamentos saudáveis. Por sua vez, esperamos que a partir dessa conscientização cidadã o ouvinte possa se posicionar melhor na busca pelo seu bem-estar próprio, de sua família ou comunidade, comportando-se como sujeito ativo do processo de promoção de sua saúde. Que ele possa compreender por que saúde é mais do que a "não doença", assim como outros aspectos relativos aos determinantes da saúde. O programa é produzido na forma de série temática composta por cinco programas de curta duração, "pílulas", com cerca de quatro minutos cada, e veiculado na rádio UFMG Educativa e em rede de rádios conveniadas do interior do estado de Minas Gerais, no Brasil. A programação também pode ser acessada em tempo real pela internet, na página www.medicina.ufmg.br/radio. Neste mesmo sítio é possível consultar as edições anteriores. Atualmente o programa é veiculado em 20 rádios, incluindo a rádio universitária (UFMG Educativa 104,5 FM). Uma das próximas ações a serem iniciadas brevemente é a busca e identificação de novas rádios interessadas em também veicular o programa, sem ônus para ambas as partes. Um importante divulgador deste trabalho se baseia na ação de transcrever as perguntas e respostas veiculadas no programa e publicá-las em dois jornais impressos locais: Super Notícia, tablóide com uma das maiores tiragens do Brasil, e Jornal O Tempo, distribuídos na região metropolitana de Belo Horizonte. Um problema tem sido a baixa participação espontânea do público na produção dos futuros programas.

A Study of Science News Reading Habits

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Abstract. Science communication generally refers to media aiming to talk about science with non-scientists. It is done by professional scientist but the role of mass media especially newspapers is very important in science communication. The science journalism has emerged an important dimension of journalism. There is no doubt that the knowledge of science subject of daily lives is very necessary for society. The wide application of science and technology has further necessitated us to know more and more about science subjects. The youths are most important group for the application of science technology and for adoption of scientific temperament in our daily lives. Their effort in the direction of gaining science knowledge is very important matter. Reading is one very important human activity as for as knowing or application/adoption of scientific information is concerned. Major portion of academic achievement is also related with reading exercise. We read not only for gaining scientific and other kinds of knowledge but also for entertainment, information and for other purposes. People read various kinds of publications for knowledge of science. Among them newspaper is one very popular media which play an important role in the dissemination of scientific information among common mass. Earlier Study reveals that more than 96 percent of newspaper reading is still done in the print editions, and the online share of the newspaper audience is only a bit more than 3 percent. Further, Newspaper reading habit is one very important aspect in popularizing science journalism .The reading habit decides a lot about how people take and think about scientific information. College students are important part of demographic segment who are expected to read daily newspapers and that newspaper publishers have sought for years to attract them to read daily newspapers. Importance of the study area-The study of reading habit is an important area of research in mass media. How are youth reading science news? The answer of this question can tell us many things. It helps to know the habit and behaviour of youth as for as the reading of news stories are concerned. This study may be very useful in improving the presentation of science news in newspapers. It can give idea to reporters about how to improve the quality of science news .It can also describe a lot about the present trend about how people specially youth take science communication. It can also reveal us how science news reading differs from general news reading habits.

Aims and objectives of the study– The main objective of the study is to know the reading habits and popularity of science news among the youths. It has tried to know in detail about how youths read and behave as for as science news is concerned. It has taken various aspects of science news reading in newspapers.

Methodology–This study has been done through survey method. A questionnaire has been prepared for it. It contains structured questions. This survey has been done among college going students of Kanpur city. A random sampling method has been done for the selection of unit and for the data collection. Data analysis conclusions and suggestions–The result has quantitatively and qualitatively been analyzed in detail. It has also been graphically presented. Important conclusions and suggestions have been given.

Keywords: Science news, Youth, Reading habits

Science Communication through Mass Media in Mother Tongue

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Abstract. Today, we are living in media society, according to agenda setting theory; the media is not only deciding the political issues in our society but also changing our life as well as behavior. The role of media becomes much widened in our day to day life. Now it is not only the 4th pillar of democracy but it in position of determining the pace of other pillars of democracy like Judiciary, executive and legislative also. Now a day, we can not imagine a society without any mass media. Mass media are deciding social ethics. With the opening of satellite communication mass communication & mass media has become inseparable part of Human life. Mass media becomes very important while communicating ideas intended to change behaviors of people right from developing awareness to adoption on of an innovation.

In India large majorities of the population is illiterate and hence have no scientific temperament. Moreover, more than 65 per cent of India population is living in villages, bound by traditions, deep rooted attitudes and superstition. This is a challenge for any science communicator. It is only through persuasive influence of mass communication, the illiterate and backward population in India can be directed towards any social change required for development of scientific temperament. Thus, mass media has important role to play in enlightening the masses to raise the standards of their living and improve quality of life with science & Technology.

The Indian media is under pressure of TRP. Due to this, Indian media is presenting only sensational, hyperbolic & false story. In these circumstances, unfortunately our media is not exploring scientific truth. Our society reflexes traditional values and sometimes it reacts as orthodox society. In this situation, scientific temperament is necessary in our society. So, we have to popularize Science. The main role of media is to inform and entertain the people, so we have to develop the interesting science fictions. Science have widened gap with art and literature. We have to fill this gap through creative writings of science & technology. Mass media is using new innovations of science and technology but under pressure of TRP and unethical practices, it is using to spread orthodox through mysterious programmes. The basic postulate to popularize the science is that, the science communication should be in mother tongue.

This is a small study about how scientific information and knowledge should given in mother language of any society .This study has been done in reference to Hindi language which is the third largest speaking language in the world. This study has adopted survey as well as observation method.

It gives very useful information about effective science communication in mother language irrespective of any language.

Science for Children: A Case Study in two Brazilian Newspapers

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Abstract. In Brazil, there are only a few media vehicles dedicated to science communication for chilfren. However, we believe that childhood is an approppriate time for laying a scientific foundation that will stay with these young readers throughout their intellectual lives. Even before they start going to school, children interact with natural phenomena and technology that incite their curiosity and their interest to know how the world works.

This study explores science coverage in the children's supplements of Brazil's two main newspapers for the elite classes, *O Globo* and *Folha de S. Paulo*. The corpus comprised texts containing science topics that were published in the two supplements (Globinho and Folhinha, respectively) during a one-year period (2008). Following analysis of these texts and their images, the editors and reporters assigned to the two supplements were interviewed about the processes involved in producing the material under study.

Findings suggest that although neither supplement specializes in science communication per se, they are both valuable vehicles for conveying information on science topics to a young audience. We identified 314 mentions of science topics (51.6% in Globinho and 48.4% in Folhinha). The mentions were classified by type of text: 30.9% consisted of news pieces; 14.3%, tips on upcoming exhibits or events related to science topics; 10.8%, tips on books or games related to the sciences; 10.5%, games and puzzles; the rest consisted of comics, short notes, letters and drawings by readers, short stories and poems, and tips on plays, movies, or television programs. The fields that received the most attention were the biological and human sciences, each accounting for 23.6% of the texts.

From our analysis of collected material and our conversations with the journalists at these two supplements, we saw that at both Globinho and Folhinha, writing about science and technology for a young audience is not considered synonymous with transmitting information in a childish or simplistic manner. To the contrary, it is important that the young reader at times feel challenged to understand topics and concepts that are new to him or her

Yet the supplements rarely inform their readers about the risks or controversies associated with science, something that might encourage a more in-depth debate about scientific research. We thus hold that science communication for the young public should respect children's ability to think and reach their own conclusions on science topics—even when these are controversial—so that young readers are encouraged to take part in their world, including the world of science, as well-informed citizens with the ability to make decisions. This implies that it is also important to make room to discuss controversial issues and the impact of science and technology on society, without overlooking a fundamental facet of science communication for children: the need to evoke their curiosity on topics of science and that which is happening around them.

Knowledge Investment in Agriculture through Mass Media Resources

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Abstract. In the current agricultural scenario, knowledge is a critical input with potential to enhance the system productivity manifold. The Indian Council of Agricultural Research (ICAR) continues to generate vast amount of user-friendly agricultural knowledge through its wide network of 98 research institutes and 578 KVKs across the country. Strong backward and forward linkages with farmers are essential for interactive communication to reap full potential of promising science and technology interventions. In an innovative approach mass media is being mobilized to act as an active partner for knowledge sharing and message multiplication. A National Agricultural Innovation Project (NAIP) funded project was launched with a view to utilize different modes of communication in an integrated manner for accelerated and sustainable delivery of messages. Mass awareness and diffusion of agricultural technologies at ground level is the overall goal. In a bid to improve and strengthen media relations, 16 media meets and interactions were held in different centers of the project across the country wherein more than 500 media persons from print and electronic media participated. This activity culminated into more than 1000 newspapers clipping in regional/national media. AIR and TV programmes are also being facilitated by the project teams in which subject matter experts share their experiences and directly interact with the farmers. Video films and audio capsules on success stories of agricultural technologies and innovations of farmers have been produced and ready for dissemination and telecast. Showcasing of ICAR technologies is an important activity of the project with ample opportunity to develop a direct interface with the technology users. So far 23 events have been arranged where more than 2,500 farmers/ entrepreneurs received first hand information on the technologies direct from the technology generators. Nine communication centers to interact with media are being developed as models in seven states spread from Sub- Himalayan region to coastal and central Indian covering agriculture, horticulture, livestock and other allied sectors. Capacity building of agricultural scientists is also a major activity to strengthen and enhance the communication skill, especially with mass media. Constraints, lessons and impact will be discussed.

Keywords: Knowledge dissemination, Mass media, Agricultural communication

Science Communication through Doordarshan With Special Reference to Doordarshan Kendra, Sikkim

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Abstract. There is a general lack of understanding of how advances in science and technology affect our lives. Against this background, controversial or sensational reporting on food safety, bird flu, global warming etc. can leave citizens confused and frightened and science misunderstood. This is why scientists are increasingly asked to communicate their work to a wider audience and science communicators and the media to act as the responsible bridge between the scientists and society.

To disseminate scientific information and to inculcate scientific temperament among the general mass we have been using print, audio and audiovisual media. If we concentrate on audio visual media, Doordarshan is playing a very significant role in the process of inspiring rural masses towards accepting social changes, establishing a constructive means for the upliftment of the common people and building a scientific temperament among the mass from its beginning. Though the history of Doordarshan in Sikkim is not very much old, but is giving a deliberate, planned and sustained effort to inculcate scientific temperament in the rural mass.

This paper is an attempt to analysis the programme content of Doordarshan Kendra, Sikkim as well as to find out various constrains in the process of science communication. The present work also emphasizes the assessment of the impact of the science programmes on target audience.

Keywords: Science communication, Broadcasting, Doordarshan Kendra of Sikkim

Introduction

‘Development describes the growth of humans throughout the lifespan, from conception to death. The scientific study of human development seeks to understand and explain how and why people change throughout life’. Kendra Cherry

The influence of science on people’s lives can be ignored at all. But a considerable measure of public mistrust of science and fear of technology exists in today society. The gap between science and common man needs to be bridged for which effective science communication is required.

Science communication is facing various problems as chatting capability, mass accessibility, cultural like-minded, linguistic and socio-cultural variety, socio-political obstacles, proper process of communicating science successfully and professionally and inculcating scientific temper among the people etc. But for the society developmenent, it is extremely necessary to bring a change in the attitude of the general mass from the non-scientific to the scientific one and to motivate them living in a scientific life. Science communication means to acquaint the masses with scientific knowledge for scientific awareness. All the arguments come to end when society mirrors a wide gap between scientific community and common mass, which needs to be shortened. To get rid of centuries age old misbelieves and superstitions and accomplish a familiar platform for science for mass, regional network and languages are very significant.

There are Print, Electronic and New Media. Each and every medium is very much significant in this regard if the due role is played. Among the all the modern media television is one of the most vibrant medium. Before coming the Disc culture, this medium was not so much accessible and was restricted within a certain strata of our society. The impact of audio visual media cannot be overlooked. It is not only attractive but also influential which is thought to be more viable to make common man grasped the scientific temperament beyond the age bar. For this reason science related information can be disseminated through this medium at ease to the common mass.

Significance of the Study

Science communication does not only mean to include the word ‘science’ as the contents. Talk ‘about science’ not ‘on science’ is a general tendency which should never be devoid of scientific contents. The very basic method of science communication means explaining common science ‘how and why’. Nobody enjoys science unless it is linked with the linguistic stuff of cuts and curls, covered with surprising and genuine facts, and flavoured with piquant instance through cheerful presentation. So, there is awful necessity for dissemination of science sense among the common masses. But selection of the right medium, format, style and language for science communication is very important task considering background, sentiment, curiosity and amusement of the target audience.

It is true that TV is most acceptable medium in all stage in the country like India. There are many more Private Channels. But still Doordarshan has its own importance in common people’s mind. In this research work we have taken DD Sikkim as case study. Because Sikkim is still unexplored in this context. There are 120 big and small newspapers, All India Radio and Doordarshan in Sikkim as the major media for communication. The attack of private audio visual channels still is not seen. Doordarshan is very popular channel out there especially in the rural areas. Though there are a few local cable television channels. Sikkim Doordarshan is trying its level best to inculcate scientific temperament among the common mass along with its all sort of constrains.

Objective

1. To analyze the impact of Television on general masses in communicating science.
2. To explain the role of Doordarshan in Sikkim
3. To study the various constrains faced by DD Sikkim in the field.
4. To assess the effectiveness of DD in this regard.

Research Methodology

The study is based on conceptual data. It is basically a case study. To collect the primary data, we followed interview & observation, case study method. For collecting the required information to complete the work we have contacted and taken help a few relevant sources. Keeping in view the complexities of social customs, cultural norms and values of the society, we specially have given stress on informal interview. For secondary sources we tried to explore a few web sources, Journals and books.

Discussion

The field work mirrors a few very important data. On that basis the discussion may be started. More than a generation ago, Marshall McLuhan predicted that television would bring us together into a “global village”. Our world is more and more a single “information society”, and television, as the world’s most powerful medium of communication, is a key part of that society. Television can be a tremendous force for good. It can educate great numbers of people about the world around them.

The introduction of television was not an exception. The birth of the electronic television age is almost impossible to pinpoint exactly. Due to the numerous contributors that helped to develop this new medium, it is even more difficult to acknowledge any one person for its invention. The time span between the origin of the electronic television until its full understanding of how it functioned extends from the age of Thomas Edison (1847-1931) to the mind of Idaho farm boy, Philo Farnesworth (1906-1971).

Television in India, came in delay, after having the approval and consent of the government to a long awaited demand and needs of many Indians from different segments like scientists, educationists, politicians, businessmen and other institutions and professional study centres etc. With the financial assistance as acquired from UNESCO and equip mental support from U.S.A, the government of India started its Delhi centre on sept15, in the year 1957 successfully. If we consider the content of television, from the very beginning, along with other entertainment programmes, science is the un separated part of programme content in Indian television scenario.

The history of Science Communication through DD in India:

The use of broadcast and digital media had opened new vestal of science journalism. Doordarshan, the national television service of India, devoted to public service broadcasting is one of the largest television networks in the world. Since its inception in 1957, Doordarshan started telecasting science programmes for students. First popular science programme telecast was *‘Vigyan Partrik’* during 1971 to 1975 which was in ‘B’ and ‘W’. In the year 1966 broadcast of agriculture based programmes had started. From 1982, 15 August colored television had started in India and brings a new ray in broadcasting. After that during 1984-92, a popular science programme named *'Quest'* produced by Calcutta, ran for eight years. A programme on growth of science in India was produced by NCSTC named *'Bharat Ki Chap'*, *'Bigyan ki Baate'*,another programme that had broadcast in every satureday. Then *'Turning Point'* was landmark programme on started in1991. It has been telecast in some regional languages also. Doordarshan also telecasts some western Television programmes. Many private TV channels such as National Geography, Animal Planet , Discovery etc are now-a-days taking up science programme seriously and after the emergence of these private channels , science and technology have become interesting for every people.

In North East Guwahti DD is the first centre.The history of Doordarshan Guwahati can be traced back to the year 1982. It was in this year that India hosted the 9th Asian Games and this event in New Delhi brought about a far-reaching change in the social and economic lives of people of Guwahati.

In the same year Doordarshan Kendra Guwahati was commissioned with LPT status on 19th November 1982. Later it was converted to HPT in the month of January 1985 with a transmitter power of 10KW covering range of 89-120 Kms. The Kendra transmits its programme through III/09 channel Band. At the initial stage, the Kendra was run in a rented House at Panbazar, Guwahati. Later it was shifted to its permanent area at R.G.Baruah Road Guwahati on 7th February 1992. The complex has got better facilities for recording and transmission with modern technology. It has got two colour studio set up. Besides, there is a studio for recording of North East programme separately (PPC, NE) and a computerized Earth Station for networking. Presently this Earth Station is utilized for Uplinking the Guwahati Doordarshan programme for networking to the entire country through INSAT-4B. programme. There was another achievement of DDK, Guwahati that the induction of External Satellite Service from 14th March 1995 whiles the North East News service begun to telecast from Guwahati from 1st March 1997 onwards. Moreover the other significant achievement of PPC (NE) was the installation of North-East Satellite Service (24 hours) with effect from 27th December 2000.

Being a public broadcaster Doordarshan always leads in production of programmes on mainly information, education and entertainment. Last year, DDK Guwahati telecast 31% informative, 24% educative and 45% entertainment programmes. Most of the content focuses science issues.

Doordarshan in Sikkim

Though completed in 2003, with 100-metre-tall tower in misty clouds the Gangtok DD centre still could not provide regular programmes like daily news bulletins catering to Sikkim. Doordarshan Kendra in Sikkim started telecasting programmes on regional language from the year 2003. Apart from these programmes in Nepali, the centre is a mere transmission point to relay feeds of national DD channels. Instead, the Gangtok centre airs only a half an hour round-up programme on Sikkim events three times every month and a 30-minute episode on agriculture in the state from Monday to Friday. In Sikkim, they mainly focuses on broadcasting programmes aimed for educating, entertaining and providing information to both the rural and urban masses of the state.

Programmes

There are basically two narrow cast programmes being telecasted from Sikkim currently.

1. Agriculture Episode
2. Sikkim Round-up

Agricutural programmes

Sikkim is an agricultural based state. So that is the reason Sikkim Doordarshan believes that this sector should be given a primary attention. Hence, the target audience for this programme is specially the agricultural labourers. This program mainly aims at the teaching the farmers regarding new technologies which would gradually increase their agricultural output.

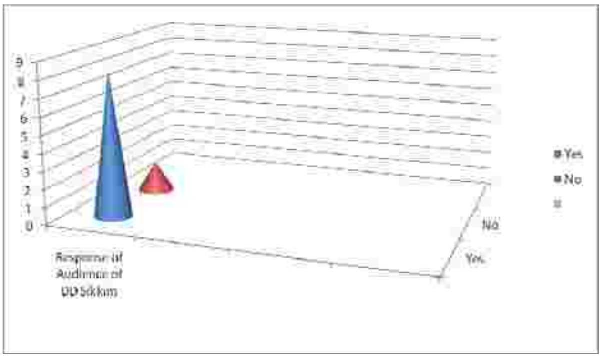
Sikkim is under process of becoming an organic state the farmers are facing serious problems while practicing agriculture without the use of pesticides and chemical fertilizers. Here, D.D. is playing an active role in teaching the farmers regarding other various alternative ways of cultivation where these fertilizers and pesticides may not be used.

Through these programmes, it also attempts to inform the rural masses regarding various schemes of Central and State government, like National Rural Employment Guarantee scheme, Self help Group, Pradhan Mantri Gram Sadak Yojna for the upliftment of the poor and the tribals.

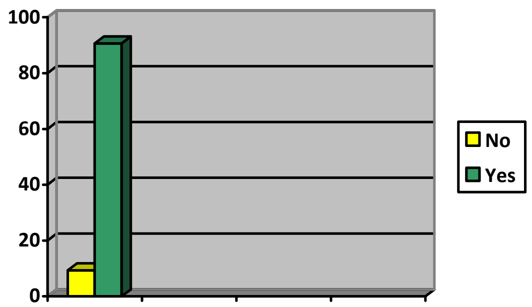
Sikim round-up

This programme basically informs the Sikkimese about the news and happenings within the State. It also covers various festivals, culture and tradition of the people living in Sikkim.

The Audience Feed Back



The audience prefers Doordarshan specially in rural areas. But they demand more programmes in their own language. The chart shows that 80.3 % watches DD Sikkim regularly .



The above chart shows that only 9.3 % target audience believe that Sikkim DD is able to inculcate scientific temperament properly in the society. The rest opined that it needs to give more time for the science related programme

Constrains faced by DD Sikkim

Though D.D. is a national network fully funded by the government, it facing lots of difficulties both mental and technical along with a stiff competition from other private players. A few problems are discussed here.

- Heavy rain and steep gradients also delays or cancels outdoor shootings.
- Landslides and road blockage due to heavy rainfall is a routine affair which affect the normal schedule of the transmission.
- Sometimes DD persons even have to work long distances for hours to reach the shooting spot.
- Unlike other private channel Doordarshan mainly focuses on broadcasting programmes focusing on education, information and not on entertainment..
- Less number of staff (especially trained in Science Programme).
- Inadequate infrastructure.
- Lack of common awareness.

Conclusion

There are 31 regular employees at the centre and around estimated 2 crore is annually spent on the salaries and the maintenance cost in Sikkim DD. There it is strictly followed the code of ethics of broadcasting due to which it cannot sensationalize issues like other private channels. Its real motive/objective is not profit or to raise the T.R.P. but to work for the people towards the path of development and nation building. Sikkim DD has its own production team and aims to supply the people with more educative, informative programmes and scientific awareness inculcating is one of them. The D.D Kendra is looking forward to extend its regional programmes. Television spreads information in an accessible format to viewers quite quickly. When an important event occurs, the audio and visual proceedings of that event can be broadcast in order to inform viewers of the event. Practically this centre needs special attention of the Government. More trained staff with required infrastructure may solve the various problems because the target audience is there to get the information.

Acknowledgement

Mrs. Champa Bhowmik, the Production Executive of the D.D. Kendra Sikkim, Students of Journalism and Mass Communication, Sikkim University.

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Communicating Science: Through Mass Media to Masses

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Abstract. Communicating science through mass media is not like communicating or covering other subjects or beats. It carries not only information but also an attitude, a temperament and a way of life that is conducive to a rational living. Today the challenge before the science communicators is even greater with the development of technology and new media. The biggest challenge before a science journalist is how to communicate science related information to its receivers with clarity and understandably in such away as it percolates to the masses. The basic purpose of science communication is not only to tell the masses what is scientific and what is superstition, but also to develop among them the scientific temperament, a scientific approach to the things enabling them to decide themselves what is rational and what irrational, what is acceptable logically and what is to be abandoned as rubbish. It is enabling the masses to be patient and innovative in time of crises. Though the rapid developments in the field of information technology, biotechnology and also medical sciences, have led to considerable increase in popular science writing and coverage of science related events over the years, but we have miles to go to make our popular science writing qualitatively acceptable.

Keywords: Science, Mass media and masses

Scientific Communication Practices for Sustainable Development: A Participatory Approach

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Abstract. In this research paper, an attempt has been made to identify and delineate the role of participatory communication science in general and specific roles of various communication channels in meeting the goals of sustainable development in particular. In case of specificity, the manner in which science communication plays its role for sustainable development is discussed in detail . Sustainable development is an integrated and holistic approach that calls for the participation of individuals, groups, organizations(particularly the NGO's),public and governments at local, regional, national and global levels. The goal of sustainable development is not confined to one locality or region or nation but embraces the entire globe. It extends not for a few years, but for the distant future too. Thus spatially or temporally its scope is very wide. It requires people to think globally and act locally for the development and growth of rural sectors.

Informed and conscious citizens can utilize poverty alleviation programmes effectively and successfully. Informed and conscious citizens can also play a responsible role in promoting environmental protection in various walks of their lives.. In fact to fulfill the goals of sustainable development there is an indispensable need to mould a lifestyle that is environment friendly and equitable all over the world.

Communication Science in general and various communication channels in particular have a potential role to play in moulding such a lifestyle. Poverty eradication, protecting the environment, reducing the consumption of non-renewable resources and increasing the use of renewable resources, conservation of biological diversity, land degradation and deforestation, waste management, using appropriate technologies, land reforms, population control and stabilization, upholding basic human rights, social welfare and women's upliftment, promoting intra-generational and inter-generational equity, and participation of people from individual, local levels to global levels, being the various important objectives of sustainable development, different communication channels have a potential role to play in fulfilling these objectives. Though communication alone is not sufficient to meet these objectives, it is a crucial element in facilitating the fulfillment of these objectives.

Introduction

The concept of sustainable development has occupied a central place in every aspect of human life today. It is a multidimensional and multidisciplinary concept covering almost all spheres of human activity. Sustainable development has become the concern of economists, ecologists, administrators, lawyers, communication exports, environmentalists, human right activists, feminists, scientists and NGO's. In other words, it has become everybody's cup of tea. Since the present study aims at studying the role of communication in sustainable development without identifying the various implications of the concept, therefore, an attempt has been made in this research paper to discuss the various implications of sustainable development.

The world commission on environment and Development (WCED,1987) defined sustainable development as the 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' It is observed that sustainable development is a coin which consists of two obligations on its two sides. One side is the alleviation of poverty and the other, the protection of environment. Sustainable development is very much linked with the involvement and active participation of people. It is a holistic concept that can be on the global, national, local and individual scale. Communication is an intervening variable without which the materialization of different goals of sustainable development is not possible. Therefore. Communication has the key role in facilitating the participation of people relating to sustainable development.

Conceptual Framework

The present study has been taken up with the following theoretical framework. There are a myriad of theories and models of communication, but there are only a few theories and models which deal with the questions of development. Therefore it is useful to discuss the relevant models and theories in the context of the present study as follows.

Development media theory deals with the task of media in developing countries. It emphasizes the positive uses of the media in national development and for the autonomy and society. To a certain extent elements of this theory favour democratic and grassroots involvement, thus promoting participative communication models (Mcquail,1987). The one thing of the media is the acceptance of economic development itself and often the correlated nation building, as an overriding objective. To this end, certain freedom of the media and of journalists is subordinated to their responsibility of helping in this purpose. Collective ends rather than individual freedoms are emphasized. With the failure of the Dominant Paradigm of development , and its communication approach in bringing about the expected change, there took place a thinking about the alternative paradigm of development which led to the emergence of the concept of another development and subsequently a more specific one, sustainable development. With regard to communication also, a major shifts has taken place from top-down authoritative model of communication to a two way horizontal and participatory model of communication.

Significance of this research Study

There have been many studies carried out on development and communication, media and development, environment and media, environment and communication and communication, rural development and communication media, traditional folk media and development and participatory development communication. But, though sustainable development is the latest and present trend of development, so far, proper attention has not been paid to this area from communication point of view. Therefore, it has been felt worthwhile to study the role of communication for sustainable rural development.

Research Questions

Sustainable development being the latest and the present trend of development, the broad aim of the study is to analyze the role of communication in sustainable development and to recommend a communication strategy for sustainable development.

Objectives of this study

a. To identify the implications of sustainable development.
b. To find out the policies and programs of Indian Government towards sustainable development.
c. To study and analyze the role of communication science in sustainable development.

An empirical study has been carried out in a backward and environmentally affected district in Orissa.

The following aspects were sought to be examined in Koraput , Orissa.

a. Role of Communication in the success or failure of poverty alleviation programs.
b. Awareness about environment, Family Planning and reflection of that awareness in their lifestyles.
c. Source of information to people and their media habits.
d. Role played by various communication media in relation to combating pollution and in connection with environmental movements.
e. To recommend a communication strategy for sustainable development.

Role of Communication for Sustainable Development

Communication is a basic instinct of man. It is the fact of life of not only human beings, but also of animals, birds and other living beings. Communication maintains And animates life. It is also the expression of social activity and civilization. It leads people from instincts to inspiration through various processes and systems of enquiry, command and control. Communication integrates knowledge, organizations and power and runs a thread linking the earliest memory of man to his noblest aspiration through constant thriving for a better life. As the world has advanced, the task of communication has become ever more complex and subtle to liberate mankind from want, oppression and four and to write it in community and communion, solidarity and understanding. Mass communication comprise the institutions and technology by which specialized groups employ technological devices(press, radio, films etc.) to disseminate symbolic content to large, heterogeneous and widely dispersed audiences.

Poverty eradication, protecting the environment, reducing the consumption of non-renewable resources and increasing the use of renewable resources, conservation of biological diversity, controlling various types of pollution, land degradation and deforestation , waste management using appropriate technologies land reforms, population control and stabilization, upholding basic human rights, social welfare and woman’s upliftment, promoting intra-generational and intergenerational equity and participation of people from individual, local levels to global level, being the various important objectives of sustainable development , different communication channels have a potential role to play in fulfilling these objectives. Though communication alone is not sufficient to meet these objectives, it is a crucial element in facilitating the fulfillment of these objectives.

Communication policy and Strategy

Strategies that include communication for sustainable rural development as a significant aspect of agricultural and rural development are sorely needed. Efforts in this direction are being made, but governments have yet to recognize fully the potential of this factor in promoting public awareness and information on agricultural innovations, as well as on the planning and development of small business, not to mention employment opportunities and basic news about health, education and other factors of concern to rural populations, particularly those seeking to improve their livelihoods and thereby enhance the quality of their lives.

Rural development is often discussed together with agricultural development and agricultural extension. In fact "agricultural extension" is often termed "rural extension" in the literature. In contrast, rural development includes but nonetheless expands beyond the confines of agriculture, and furthermore requires and also involves developments other than agriculture. Accordingly, government should consider the establishment of a communication policy that while supporting agricultural extension for rural development also assumes the role of a "rural extension" service aimed as well at diffusing non-agricultural information and advice to people in rural areas.

A communication policy would aim to systematically promote rural communication activities, especially interactive radio but also other successful media such as tape recorder and video instructional programs. Computers and the Internet may not yet be accessible to rural communities but they serve the communication intermediaries and agricultural extension agents who provide information to rural populations. Other devices such as cell phones hold considerable promise for the transfer and exchange of practical information.

For reaching the final agricultural and basic needs information users in rural areas today, radio is the most powerful and cost-effective medium. However, other traditional and modern communication methods are equally valuable, depending on the situation and availability, like face-to-face exchanges (via demonstration and village meetings); one-way print media (such as, newspapers, newsletters, magazines, journals, posters); one-way telecommunication media (including non-interactive radio, television, satellite, computer, cassette, video and loud-speakers mounted on cars); and two-way media: (telephone, including teleconferencing, and interactive (Internet) computer).

Information and communication technologies (ICTs) have proved to be important for Internet users and for the intermediate users who work with the poor. Pilot experiences show that various media are valuable for assisting agricultural producers with information and advice as to agricultural innovations, market prices, pest infestations and weather alerts.

ICTs also serve non-farming rural people with information and advice regarding business opportunities relating to food processing, wholesale outlets and other income-generating opportunities. In the case of non-agricultural rural development interests, a communication for rural development policy would aim to promote diffusion of information about non-agricultural micro-enterprise development, small business planning, nutrition, health and generally serve to provide useful, other-than-agriculture information.

By its very nature as mass media, communication for rural development can provide information useful to all segments of rural populations. However, it would serve as a first effort toward advancement of "rural extension" services and activities aimed at rural development concerns beyond those of agriculture. Thus, extension and communication activities would be expected to work in tandem, allied in the common cause of supporting income-generating activities, both agricultural and non-agricultural.

Concluding Remarks

The discussion mentioned above shows that though there are many definitions and multiple dimensions to sustainable development, these definitions and dimensions are not contradictory to each other but they corroborate each other. Broadly, the sustainable development can be described as the poverty alleviation i.e. to enable the present generations to meet their needs and environmental protection to enable the future generations to meet their needs. In relation to communication , it implies that communication in general and various communication channels in particular have a vital role to play in creating awareness about the various poverty alleviation programs initiated by the government; in the problem articulated by poor, and thus, in bridging the gap between the planner and the beneficiary. Environmental protection and promotion and population control being the other broad dimensions of sustainable development, various communication channels have a responsible role to play in informing, educating and conscientizing the people about various environmental issues and promotional program and sustainable use of natural resources, using renewable sources of energy, conservation of biological diversity, waste management, prevention and control of pollution, family planning, etc. Besides, communication is of vital importance in promoting human rights, gender equality, social welfare and peace. Since the sustainable development calls for the participation of people–individuals, national and international levels, various communication channels are of great importance in facilitating the participation of people from individual, local levels to global level. Besides, since sustainable development calls for a lifestyle that is equitable and environment-friendly in moulding such lifestyle throughout the globe, communication has a potential role to play.

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Science Communication & Media in India in the 21st Century

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Abstract. If you are a layman, scientist, educationist or a media person, you may have observed that over the last few years there is a fast emerging trend where old communication methods are being rapidly replaced by a wider inquiry and dispensation based digital process. This shift in trend or attitude is definitely slightly upsetting for media persons who may have grown up under the earlier authoritative school of thought, where the reporter was placed at the centre of the fact dispensing process. This is particularly true for India where modern science communication methods continue to show great scope for improvement, despite recent advances and innovations.

In the present system, communicators have to write about science topics to encourage interest and learning in the average reader. There is more responsibility placed on the communicator to 'learn' for himself, as he uses his skills to effectively dispense knowledge. For effective science communication, there are a wide variety of methods that are possible before the average person. These methods include the time honoured traditional print media now largely propped up with the digital media. Perhaps more widespread in both the urban and rural scenario is the use of the print media chiefly making its presence felt in the form of books, pamphlets, newspapers and magazines to name a few. Emphasis on the type of each method varies from place to place in their implementation and efficacy.

There can be no doubt however, that in years to come, the role of computers, digital media, electronic publishing and the Internet in science communication, cannot be underestimated. The ease of communication and the comparative easy availability of recent, relevant knowledge from all over the world definitely make these communication methods a winner. The present paper deals with a spectrum of 21st century media methods; applied aspects for the future of science communication in India, their relevance in the global scenario, with emphasis on the use of computers, electronic publishing and the internet to serve mankind better.

Keywords: Science communication, Media person, Effective, Innovations, Computers, Internet, India, 21st century

Communication Errors in Transferring Scientific Information from English to Hindi

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Abstract. In a country like India where different languages are spoken, it becomes necessary to make the standard text available in regional languages or at least in the national language i.e., Hindi. For this translation from English to Hindi is required. Translation is referred to as a process to transfer information from a source language to a target language. It is well versed that it is influenced by cultures, society, policies, etc. and in this way translation is another means of communication. Scientific translation is a specialty within this area that must be also considered from the point of view of science communication. Translators have to take important decisions when translating scientific texts, such as the selection of words that scientists, journalists, teachers or other science communicators will use in their daily activity, the use of phrases that belong to the common target language, the translation from a culture to another.

When newspapers publish science news, they usually use as sources press releases, news from agencies, and sometimes a secondary source. When it comes to publish the news in Hindi newspapers, the original information in English can suffer some modifications during the translation process. They may eventually lead to conceptual errors. The present study aims at an analysis of such errors in articles in newspapers and their possible implications to the society.

Media and Science Communication Creating Science Opinion Leaders—A Case Study of Science News Magazine

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Abstract. Media play an important role in science communication by bringing scientists/experts together with the public, involving scientists/experts in transferring science information in an easily-undertook way, and thus engage people's daily life with science. This paper uses Paul F Lazarsfeld's Two-Step Flow Theory to analyze Science News Biweekly's efforts in science communication, including composing the science communication column and organizing activities like online training course for science journalists, seminars including various participants and discussing science's role in policymaking of public health, GM food, and urban planning, and science-media exchange programs involving scientists and journalists. By all these activities, Science News Biweekly first tries to train scientists/experts and journalists into opinion leaders who are both good at science knowledge and communication, and then create opportunities for them to radiate their effects to the common people in a way widely engage the public. The analysis finds that because the second step, that is the interpersonal communication, is thought to be more important in convincing people to believe a certain scientific information and thus influence decision-making, media can actually try to do more to "mould" opinion leaders and improve people's perception of science knowledge in the first step. And in the field of science and technology, opinion leaders' role in the government's policymaking is much more significant. Thus media should try more to "train" more opinion leaders, so as to promote science communication effectively.

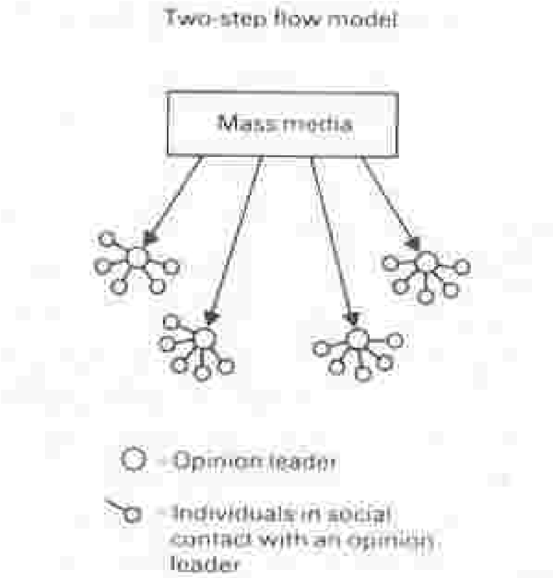
Keywords: Science communication, Opinion leaders

Introduction

Media play an important role in science communication by bringing scientists/experts together with the public, involving scientists/experts in transferring science information in an easily-undertook way, and thus engage people's daily life with science. However, Chinese scientists were tending to be reluctant to do science communication. In two surveys done by *Science News Magazine*, about public health communication and GM food safety communication respectively, 56% and 63% participants thought that scientists haven't done enough in science communication (Tan & Jia: 2010a, Tan & Jia: 2010b).

The fact that scientists' efforts to communicate their researches have been decreasing, was partly due to the ignorance of importance of communication and partly due to the lack of ability to do dialogues with the public.

Besides, more than 50% science journalists thought that it was hard to receive help and cooperation from scientists. Scientists' reluctance to do science communication and popularization has become one of the reasons why there was so much misreporting of topics related sciences. This directly leads to the lack of opinion leaders in the field of Science, especially about controversial topics like GM food and TB vaccine. Without accurate information from opinion leaders, interpersonal communication among the public tends to be in chaos.



Source: Katz & Lazarsfeld (1955)

According to Paul F Lazarsfeld's Two-Step Flow Theory, information from the media moves in two distinct stages (Katz & Lazarsfeld: 1955). First, individuals (opinion leaders) who pay close attention to the mass media and its messages receive the information. Opinion leaders pass on their own interpretation in addition to the actual media content. Opinion leaders are quite influential in getting people to change their attitudes and behaviors and are quite similar to those they influence. So it is of great influence and importance to "mould" influential opinion leaders in the field of science, who can transfer accurate scientific information to the public and avoid personal dissemination of pseudoscience.

Analysis: Case Study of Science News Magazine

Science News Magazine, operated under the Chinese Academy of Sciences (CAS), is the first and only professional news magazine targeting the science community in China. It aims at serving for scientists and promoting the development of China's science. Its readers include policymakers like health minister Chen Zhu, science minister Wan Gang as well as all academic leaders and chief scientists from CAS and CAE (Chinese Academy of Engineering), NSFC (National Natural Science Foundation of China). With widest readership in China's science community, *Science News Magazine* has the base to choose science opinion leaders. And a professional medium, it has the platform to provide dialogue between science opinions leaders and the public.

Also, in partnership with British Embassy, China Science Reporting Network and the World Federation of Science Journalists, as well as China Association for Science and Technology (CAST), *Science News Magazine* has done a lot for advancing development of science communication in China and engaging scientists to transfer their professional knowledge to the public. Sponsored by British Embassy, *Science News Magazine* designed and organized the Science into Policymaking Series Seminars, discussing scientific evidences' role in policymaking of controversial topics like public health, GM food safety, waste incineration, and urban relocation. During discussion of such controversial topics, certain scientists were promoted to be opinion leaders and radiate accurate information to the public.

For example, Zhu Zheng from the Institute of Genetics and Development Biology of the Chinese Academy of Sciences, successfully become a typical opinion leader in the field of GM food safety after he acted as a leader in a hastily arranged session derived on the "Communication and Dialogue of Agribiotech Symposium". During this symposium, members of the general public berated and quizzed scientists on concerns ranging from the legitimate to the bizarre. A group of protestors descended on there, prompting organizers to set up a side session between members of the general public and scientists.

A group of experts, leading by Zhu Zheng, reassure the audience and answer their questions patiently. As a result, those encounter yielded great consensus and the protestors appreciated the chance to try to set the record straight. This hastily arranged session was praised as "a milestone" in the history of GM food safety communication. This shows that science communicator can and should try to provide accurate information and play a role as a bridge between scientists and the public, enhancing scientific communication and promote the right understanding of science issues among the public.

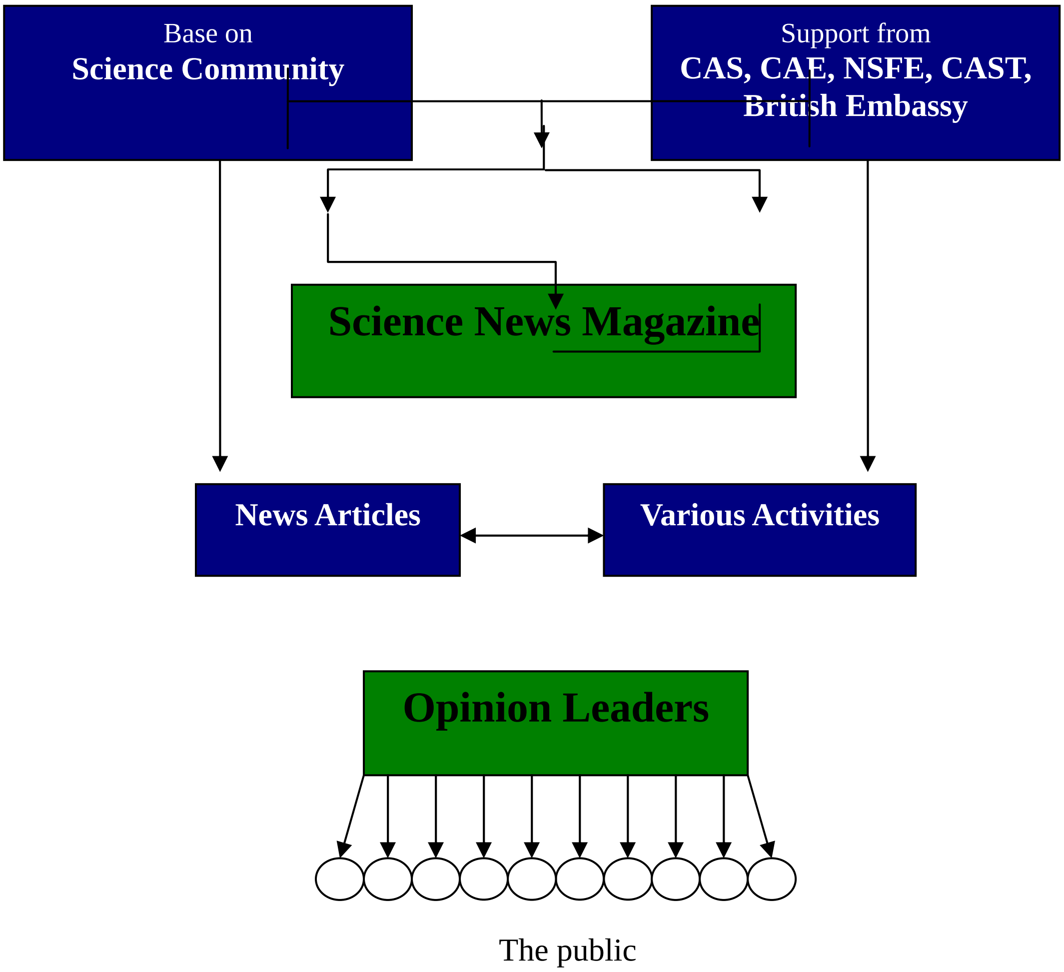
In addition, *Science News Magazine* held many other activities like Seeking Future Star of Sciences, Scientist-Media Role Exchange Programme, and so on. For the Scientist-Media Role Exhange Programme, young scientists were encouraged to work as intern journalists in media while science journalists were encouraged to work in science institutes as public information officers and public engagement campaign assistants. This prohramme not only created greater mutual understanding between journalists and scientists, but also increased the communication skills of professional and reporting capacity of journalists. Both science opinions leaders and journalism opinion leaders were created for more effective and efficient science communication.

By all these activities, various opinion leaders in various fields were chosen and moulded. What's more, owning various media resources, including blogs, websites, television, broadcast, newspaper and magazine, *Science News Magazine* has multiple channels to publicize its activities, increasing popularity and fame for all these opinion leaders and making them as influential as possible.

So far, *Science News Magazine* has planned a series influential scientific evidence based reporting like the truth of anti-dam, questions against earthquake prediction and GM food safety (Zhao: 2009). All those news reporting, together with various activities well schemed by *Science News Magazine,* promoted and branded many well-known opinion leaders, greatly facilitate science communication in China, improve the process of policymaking and increase Chinese people's scientific literacy. Of course, in the way to more effective and influential science communication, *Science News Magazine* also faces many challenges. One thing is that to organize all those kinds of activities, it needs more funding and financial support from various organizations which truly intend to enhance science communication. Another thing is that market-oriented media reform in China has led to exaggerating reporting, entertainment, and unserious journalism. To truly promote science communication, *Science News Magazine* has to maintain a top-notch journalist and operation team, to ensure highly qualified evidence-based reporting and effective communication activities.

Conclusion

From what is analyzed above, *Science New Magazine* has formed a mature system for influential and effective science communication. As showed by the graph below, *Science New Magazine* is based on and targeting at the science community, so it owns abundant recourses of scientists. With backup of such recourses and support from organizations like CAS, CAE, NSFC, CAST and British Embassy, it is able to organize various activities to cultivate opinions leaders, who will be further consolidated by media reports of itself and its counterparts. Such route which focuses on the first stage of communication, that is process of making opinion leaders by media, has been proved to be valid and feasible.



Communication Model for *Science News Magazine*

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Science Museums as a Communication Means in India: A Case Study

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Abstract. A science museum is a means to communicate science to the public. It is a museum devoted primarily to science. A public facility is much like a museum but with exhibits, often interactive in nature, that demonstrate various scientific facts. In India, there are about 50 science museums located in different cities. Some science museums are also assisted by mobile vans which are road transport vehicles equipped with computing and communications infrastructure. It is an innovative form of providing training and information.

The aim of the present study is to analyze the effectiveness of science communication through museums and exhibition in India with emphasis to rural areas. In our present work, we have conducted a survey of a sample of rural population about their exposure to science museums and exhibitions. The study revealed both positive and negative aspects of the present network. The detailed outcomes will be presented along with suggestions for betterment.

The Role of the Internet in Science Communication–Case Study of China's Network Science Communication

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Abstract. Internet, due to the spread of the unique strengths and strong communication ability, is more prominent in mass media. This article discusses the innovation of Internet applications to science communication from dissemination process, takes an example of China to explore the Internet's role in science communication, and introduces several modes in China Digital Science and Technology Museum. The article thinks that internet as a new media, not only has a new features and modes in science communication, but also has a profound impact in promoting dialogue on the whole society.

Keywords: Internet, Science communication, SNS, Blog

Introduction

The "26th China Internet Development Status Survey Report", released by the China Internet Network Information Center (CNNIC) on July 15, 2010, shows that, as of the end of June 2010, China's netizens reached 420 million! Internet has played an active role in users' access to information and community involvement.

Mass media is a major route of science communication, Internet, due to the spread of the unique strengths and strong communication ability, is more prominent in mass media. Since WEB2.0 era, the network communication patterns break through the one-way-to-many communication model, and form a "two-way, no center " communication mode. Everyone is not only a communicator but also a communication object, and changes their role during interaction with other people. Thus the main body of science communication through internet is not only educational institutions or educators, but every Internet users. It is no longer a top-down one-way communication, but the cross-connect communication. These make the Internet play an increasingly important role in science communication.

The Main Internet Application Mode Suitable for Science Communication

SNS and 3D virtual community

SNS (social network serve) social networking service is a platform-style people-centered services, encourage people to build internet-based network of social contacts, achieve real social network mapping and create a virtual network social system. There are a lot of SNS-based services, including forums and personal room.

3D virtual community is actually a service platform using 3D technology. It bases on community, through role-playing, 3D models, etc. and creates a closer with the real world context, and brings a stronger sense of immersion to the public. "Second Life" is the most well-known 3D virtual world, the Exploratorium in the San Francisco has stationed in it to promote scientific communication.

The most common characteristics of these two forms is platform and social service. Users will gradually form a similar relationship network in the real world through platform activities, so that the transfer of information are faster and more accurate, services are more in line with demand .

Blog and micro blog

Blog is actually a public online diary, with a strong personal color. It provides a form of communication with a number of Internet users through attention, message and comment. If someone's blog brought together many of the readers, the impact of his remarks is very high. Therefore, the S&T spread through the blog, can attract a lot of users to pay more attention to S&T with the personal impact of bloggers, on the other hand it enhance the credibility of the information and science education effect because of their professional background.

Micro blog pay more attention to the rapid dissemination of information, moreover micro blog is also associated with the mobile phone, and so the public can use the phone to record what they saw, heard and thought at any time. Then they issued to their audiences' phones by Micro Blog in the most refined vocabulary or pictures. Of course it will also appear in the Micro-Blog's personal home page, through the spread of the Internet it enlarge the communication range.

Wiki

Wikipedia is a collaborative writing tool for people. Wiki sites depend on many internet users' maintenance; everyone can create, correct, and add what he is interested in, even co-author a novel on Wiki sites. Therefore this form can mobilize the collective intelligence of the majority of Internet users to create and interact, so that science communication and social dialogue are more extensive.

The Innovation of Internet Applications to Science Communication

H · Lasswell, American media scholar, proposed communication "5W" mode in the "The structure and function of communication ". That is, who, says what, in which channel, to whom, and with what effect. The following will analyze the innovation of Internet applications to science communication mode from 5 basic elements of the process of transmission.

Communicators and communication objectives doesn't have a clear distinction, and form a no-center mode

Traditional science communication in general, experts or agencies of science communication play a role of communicators, the public are objects and only receive passively information, can not participate in the production of information, such as newspapers or magazines. But on network, the public can not only receive information, but also timely feedback information, even take the initiative to release information. So it is a interactive two-way dissemination. It broke the one-way communication mode, communicators and communication objects tend to unity, thus forming a no-center mode of communication.

The contents are richer and shows "Fragmentation" trends

Internet encourages public participation in the discussion and resolution, anyone can express their own views on any event or information, and therefore it enriches information, knowledge production and organization, and creates a huge source of information. The form changes from the text to multimedia and 3D virtual simulation and other forms. In addition, the development of mobile Internet technology and micro-blog application, communication content have a feature of the "fragmentation", not only in the information content is more streamlined and trivial, but also to make information more numerous and rich, even led to the differentiation of the audience to form a separate group communication pattern.

From the channel, the Internet makes people connection to the true sense of the exchanges, not just dissemination, and close to life

Internet is called the "fourth medium" following the press, radio and television. It not only has their general characteristics, but also unique advantages of digital, multimedia, real-time, interactive delivery. It also has spread fast, wide range, high-impact features; the feedback mechanism is timelier. In addition, SNS-based communities encourage the public to build their own space, and the original information space turn into private space and public space, so that the channel further stratified, information further focused and enhance the media and people close degree to production and life .

From the spread effect, the highlight of the public discourse and value, and the influence and credibility of information

On the one hand Internet broke through the barrier of time and space to make more convenient transmission of information, and communication range and influence are greatly enhanced. On the other hand, it gives each of the public equal right to speak, the public can show their knowledge and express their views, thus enhance their personal values and sense of honor, make information more easily spread. Because people participates the production and dissemination of information, it avoids preaching, and through sharing, discussion and other forms of equal exchange, enhance the credibility of information.

Take the example of China to Study Internet's Role in Science Communication

In China, science communication through the network is played more and more attention on. According to "Popular Science Infrastructure Development Report of China" (2009) show that, to the end of March 2009 popular science network facilities in China has reached 601.

These facilities refer to the popular science education web site or science sections in other sites in which Internet as a platform.

The popular science infrastructure plays a unique role. According to survey of Tsinghua University media research lab, Internet is the main channel in the public access to earthquake rescue and relief information. 36% of the respondents acquired knowledge about earthquakes from the network media, 34% from television, and 20% from newspapers. It can be seen from this data, internet has become an important channel for the public to understand scientific knowledge.

Rely on the collective wisdom to disseminate science

Internet's largest feature is to take full advantages of the wisdom of the majority of Internet users, either SNS or WIKI and so on, and show up contribution and creation of ordinary people, so that science communication has more participation of civilians, and is easy to accept.

There is a site named "Yeeyan", which brings together many of the volunteers with foreign language translation capabilities. After the earthquake in Sichuan, the site immediately launched a series of translation-based activities about disaster self-help and psychological counseling. The activities attract a large number of volunteers, who finished several foreign books' translation in accordance with procedures of professional translation in a very short period of time, such as “Earthquake Search and Rescue Manual" ,"psychological first aid". These works played a significant role in the earthquake.

In addition, China has many WIKI service providers, such as hudong.com, IT encyclopedia and so on. These sites make full use of collective wisdom of Internet users to explain many scientific terms, and some professional service providers gathered a large number of experts in various fields, and establish an expert-centric service platform to enhance knowledge management effectiveness.

Rely on the speed and coverage of internet, to spread S&T quickly

Compared with other media, the Internet has greater timeliness. The production and dissemination of information on network are very quickly, while Internet can be found in any place, and so there is a strong advantage in the dissemination space. The communication speed of Mobile is faster, and the form is newer. It brought unprecedented changes on science communication.

May 12, 2008, the devastating earthquake in Sichuan occurred. 12th at 18:00, People’s daily online launched the first mobile news of "Earthquake Relief". On 15 evening, 22 million mobile phone users received mobile news. CCTV mobile TV network released 1115 news in 7 days, with more than 15 million visits and 3.5 follow-ups.

June 25, 2010, County of Malone Qujing City YunNan province suffered heavy rainfall. At noon June 26, Qujing Publicity Department began to broadcast the disaster and relief situation through Micro-Blog. Messages updated rapidly and timely, and conveyed the information of the disaster, placement of victims to Internet users in the first time. "Micro-blogging Qujing" also won the majority of internet users’ concern and became the first-hand source of information.

"Flooding, power outages, almost a building of people gathered in the candle." At 3:23 on August 8, 2010, this micro blog was the first message from the debris flow areas in Zhouqu Gansu province. 8:57 am, the first photo of Zhouqu disaster was released by this micro blogger who named Kayne, and quickly led to the concern of users. In just an hour this picture was forwarded thousands of times. Then, Kayne has sent nearly 200 graphic about the first scene, including the bloody quagmire, the rescue soldiers ... ... many of the media in the subsequent reports used these pictures.

The role of science blog in science communication become more and more apparent

Civic scientific literacy in China is not very high, and there are still inadequate in the transmission of information about science. Many experts and technical personnel, graduate students take full advantage of blog to create a science blog circle. These bloggers have good educational background and knowledge structure, and strong sense of mission; they described various S&T events user-friendly and guided public opinion, which has played a unique role in the field of science communication.

In China, blog in Sciencenet.cn and Songshuhui.net are very famous. Blog in Sciencenet.cn is a platform of the exchange of scientific knowledge, scientific spirit, cultural, scientific methods, and to show themselves. According to a survey conducted by the end of 2008, 50.6% of bloggers have the title of professor, and 30.1% are associate professors. Because of their identities, the credibility of information they disseminated greatly enhanced. In the science communication of "H1N1 influenza", bloggers wrote a lot of popular science blog on influenza. According to the development of the epidemic, they Interpreted and inferred the pathological reasons depending on their expertise , sponsored discussions on popular issues and provided the precautionary approach and so on. In addition, they also translated the latest influenza information and knowledge to expand the public's view. From April 25, 2009 to June 21, they issued 147 blog about "H1N1 influenza", which nearly 60% written by themselves, over 10% translated. This blog circle truly became the important scientific information dissemination media.

The role of the blog is also reflected through the thread, message, and comment which make the two sides interact, and message and feedback more convenient. Bloggers with their own experience and knowledge, communicate with people who are uncertainty and confusion to the scientific issues, so that the incident itself and the solution become clearer. From the science communication, the information tends to more complete and comprehensive, and has better education effect.

China Digital Science and Technology Museum (CDSTM) and its planning

CDSTM is a national science communication Internet platform, which aims to promote public learning knowledge, discussing scientific issues, expressing insights.

CDST has been attached great importance to scientific and technical communication with practical things. This year China launched the "Chang'E II" Satellite, CDSTM conducted some follow-up reports and integrated a number of interactive resources to promote public understanding of aerospace knowledge. Since September 28 to October 7, 10 days, a total of 1.49 million people visited the resources of CDSTM, access to more than 5.36 million pages, click rate of 22.78 million.

We are now planning to change the vision, and we will integrate activities, games, community, blog, 3D interaction, mobile networks, GIS and many other applications, to build a science communication and service platform, which focus on S&T and promote social dialogue. Three main applications used in CDSTM are following:

Science SNS: Take full advantage of the features of SNS, and create a virtual community where the public can discuss science. In addition, we will give full play the leading role of science communication institutions to build CDSTM as a network habitat of volunteers, as an area for volunteers to plan and join community science activities. Such as the forum, experts will initiate topics and lead people to discuss. This will help to promote social dialogues between the government and the public, scientists and the public, and the public.

Virtual STM**:** Virtual STM is a 3D interactive world integrated online games, SNS and virtual exhibition. It combines the characteristics of physical STM to builds a virtual environment, and through communication, integration, contests, activities and other forms, to create a similar scenario with the real world. The internet users can communicate and interact by role play, operate various exhibits and join activities, which will improve the education effect.

Digital Earth about science: Digital Earth about science base on geographic information systems and SNS, add time and space elements in resources storage, and make it easier to show the process of science development and scientific spirit. At the display level, the using of 3D Earth makes the display image and visual. Because of the introducing of SNS and digital map, everyone can mark their own activities in this virtual earth, share their knowledge and sense, and take advantage of the search space to learn other people's discourse on science and technology, and skillfully make study, entertainment, recording life together.

These main modules will be based on SNS and highlight the community affect, and provide the public with better information sharing environment and interactive experience. In addition, according to the characteristic of each group users, CDSTM will create different but unique environment to improve the public's sense of belonging.

The Thinking of Science Communication on Internet

Mass participation and authoritative, correctness

Internet is just a tool, able to spread the truth, but also to spread a lie; to spread science, but also to spread superstition, so in terms of science communication, it may quite a mixed bag. Therefore, we should strengthen the management of science communication on Internet. We should improve the authoritative, Correctness of knowledge in order to guide the public's trustiness and thirst for knowledge, at the same time focus on public participation.

Strengthen the original, Avoid the homogeneity; Focus on updates, Keep up with development of S&T

Although China has a number of popular sites or science column, they are generally less well known, less access, less update, the lack of features and small social influence because these sites belong to different institutions and even individuals. In addition, many content are reproduced with each other, less original content, and a large number of homogenization of information could easily lead to information overload, coupled with the update rate can not keep up, old knowledge or content are difficult to attract the public.

Scientific Literacy of Chinese citizens Survey Results in 2007 showed that in informal education, the main channel of access to scientific knowledge and technological development was television and newspapers, other channels were broadcasting, scientific journals, books, Internet and general magazines. Thus, science communication through the Internet still has much room for development and broad prospects for development.

Internet as a new media, not only has a new features and modes in science communication, but also has a profound impact in promoting dialogue on the whole society.

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Gender Attitudes and Health: Communicating Health Among Young Girls using Channels of Mass Communication

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Abstract. Bangalore is popularly known as the silicon valley of India. While one group of people appears to be enjoying the benefits suitable for the first world the other group appear to be living in the fourth world. Though the demarcation exists in all facets of life style, the difference is rather distinct with issues related to health particularly that of a girl child. Media which should be playing a pivotal role in bringing in the change through its popular genres of programs appeared to have failed miserably in bringing the change in gender attitudes and health issues. Hence the study was undertaken. This study tries to explore different channels of communication to complete the effective process of communication on issues related to health. Data will be obtained from respondents belonging to both urban and rural part of the Bangalore City. The target respondents will belong to the age group of 12 to 19 years. The study tries to explore the possible association between gender-role attitudes and health communication using KAP theory.

Spreading News or Panic? A Study Case on Brazilian TV Coverage of A (H1N1) 2009 Influenza

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Abstract. In this study we compare through content analysis the A (H1N1) flu coverage by two Brazilian leading TV programmes: *Jornal Nacional* (JN), aimed mainly at "hard news" daily broadcasting, and *Fantástico*,an infotainment program broadcast on Sundays. Both the "hard news" and *infotainment* programs' coverage peaked in May, had the number of cases or deaths caused by the new flu as the most frequent main topic and used more often as news sources governmental representatives and physicians. *Fantástico* coverage was more conspicuously focused on the disease spreading; more often relied on the average citizen as sources and voices; and more frequently constructed stories with personalization/human interest angle. Apparently, more than the hard news program, the *infotainment* program tried to create identification with ordinary people's lives and more fully explored the dramatic potential of the spread of disease.

Keywords: Science journalism; Health coverage

Introduction

Television is one of the major sources of information about science, technology and health/medicine both for the general public and for health professionals. Images that may be evident in society are re-circulated through television (Hodgetts, Chamberlain, 1999). The news provided by television is a source of information that can be accessed regularly, extensively and in a socially recognized way. Depending on choices made during coverage of an emerging disease, television can help to promote panic or to calm its audiences.

In United States and Europe, several studies have found that viewers have been witnessing an increasing number of trivial and sensational stories, or the "soft news", entertainment or *infotainment* quotient in television programs (Vettehen, Nuijten, Peeters, 2008; Leon, 2008; Uribe, Gunther, 2007). Differently from the "hard news" approach, that is "serious" or "fact-based", concerning "traditional front page and TV news stories which address the important issues of the day" and relying on elite news sources, "soft news involves 'light' or 'human interest' stories" (Henderson, Kitzinger, 1999).

In the northern hemisphere spring of 2009, flu cases caused by a new virus strain were first identified in the United States and Mexico and then spread rapidly around the world. When the Mexican government began disseminating information about the spread of a lethal new respiratory disease, the world media also began spreading the news. On April 27, WHO raised the alert to phase 4. Less than one week after the first alert, new cases were confirmed in several countries, and the alert was raised to phase 5. Finally, on June 11, WHO raised the alert to its maximum, or phase 6 (Allam, 2009; Jones, Salathé, 2009).

Brazil, second in the Americas and fifth in the world in population, was one of the countries hardest hit by the A (H1N1) pandemic: 34,506 influenza-like severe acute respiratory cases of infection had been reported as of August 21, of which 16.7% were laboratory-confirmed pandemic A (H1N1) influenza. The first laboratory-confirmed case was detected in Brazil on May 7, 2009, and the epidemic peaked rapidly. On July 16, the first case due to sustained transmission was reported.

Coverage of A (H1N1) has been extensive and may have contributed to high levels of public anxiety. In the United Kingdom, in spite of extensive coverage, a telephone-based survey conducted less than two weeks after verified low levels of anxiety and limited behavioral changes (Rubin et al., 2009). In Saudi Arabia, on the other hand, most people expressed concern about the new flu. Saudi citizens stated they received their information about it mainly through television, newspapers, and magazines, which, along with information disseminated over the internet, may have contributed to a "misinformed dialogue" (Balkhy et al., 2010). In the United States, according to the report "Health news coverage in the U.S. media. January-June 2009," "swine flu was the number one story of the nation" at the height of coverage, that is, during the week of April 27-May 3 (The Kaiser

Foundation, The Pew Research Center's Project for Excellence in Journalism, 2009).

The leading Brazilian primetime news program (*Jornal Nacional*) coverage of A (H1N1) influenza began on April 24 (Medeiros, Massarani, 2010), followed by the same network's *infotainment* program, that is called *Fantástico*. In this study, we compare *Fantástico* and *Jornal Nacional* coverage of A (H1N1) 2009 influenza.

Methods

Jornal Nacional (*JN*) is TV Globo's main newscast. It is the audience leader of primetime television, reaching an average of 25 million people a day. *Fantástico* is an *infotainment* program broadcast by the same network (Rede Globo) on Sundays. We viewed *JN* nightly news and *Fantástico* programs from April 15 – data when CDC first confirmed the existence of the new disease and it became a potential news subject− through August 31, 2009. Stories about the new A (H1N1) flu began to appear on April 24, but after August 31, they grew sparse and were no longer covered with any regularity. *JN* and *Fantástico* stories were studied through content analysis.

We created a protocol of analysis of television coverage of the new H1N1 flu based on a protocol created for analyzing stem cell coverage (Nisbet, Brossard, Kroepsch, 2003) and on the studies of media coverage and risk perceptions of drugs, health risks, and diseases cited as references in this study.

Using this protocol, we collected data on 21 variables, seven of which are described in this paper. We classified each story by the main topics covered: (1) characteristics of the new flu; (2) economic impact of the disease; (3) increase/decrease in the number of cases or victims; (4) prevention or control measures; (5) research and development.

The main frames analyzed in this study were: (1) disease spreading/victimization: focus on the number of suspected, confirmed and/or discarded cases, as well as deaths caused by the 2009 flu; (2) containment: focus on the sanitary measures taken by governmental representatives, companies and citizens to avoid infection or to treat the disease; (3) personalization/human interest: focus on drama or tragedy of people affected by the new flu; (4) scientific-medical background: focus on previous scientific knowledge about influenza and pandemics; (5) economic impact: focus on the economic burden of disease; (6) research and development: focus on the development of vaccines or antiviral drugs fabrication.

Besides main frames and topics, we analyzed: the distribution of stories in time; sources; voices; presence of images of scientists or research laboratories; presence of contextualized information, that is, whether the reporter responsible for a story or the anchor who relayed brief news items made reference to past events, previous epidemiological data, or prevention and control measures in order to afford viewers a broader perspective of the new flu.

Results

JN stories were more frequently broadcast in May, but in July coverage peaked once more. *Fantástico* coverage, in turn, peaked only in May (Figure 1).

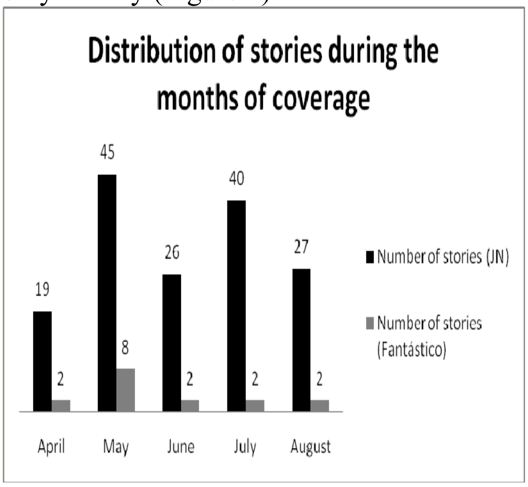

Figure 1. Distribution of the TV stories along the 5 months of coverage

In *JN*, we found five types of main topics. Increase/reduction in the number of cases (42%) and measures of prevention/control (38%) of the new disease were the most frequent main topics of aired news. F*antástico* stories, instead, addressed a lower diversity of topics: only three. Increase/decrease in the number of cases was also the most prevalent subject of stories (Figure 2).

In *JN*, we found six types of main frames. Containment (44%) and disease spreading (42%) of the new flu were the most frequent. In *Fantástico*, the new flu spreading (56%) was the predominant frame, followed in frequency by containment and personalization/human interest (Figure 3).

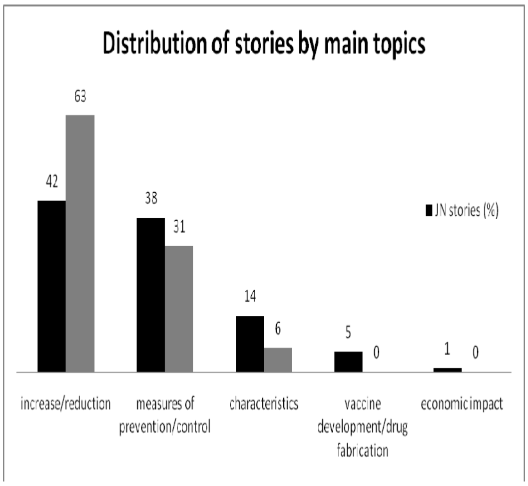

Figure 2. Distribution of TV stories by main topics

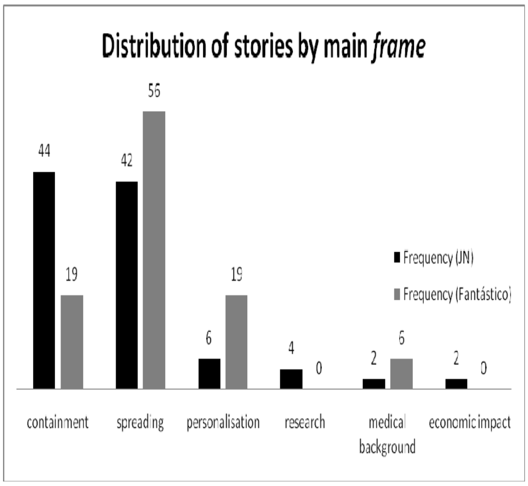

Figure 3. Distribution of TV stories by main frame

In this study, we distinguished between news sources–people and/or institutions responsible for information or opinions used to construct a story–and news "voices", people and/or institution(s) interviewed to compound the narratives. In *JN* we found a total of 310 sources; the only expressive ones were governmental representatives (59.4%), physicians (17.1%) and international authorities (10%). In *Fantástico*, governmental representatives (35%) were also the most common sources, but physicians (27.5%) and the average citizen (25%) were more frequently mentioned. The most frequently heard voices in *JN* were average citizen (36%), governmental representatives (30%) and physicians (17%). As the figure shows, in *Fantástico* the average citizen represented a still more frequently heard voice. The only other expressive voice was the physician's one, which represented 16.1% of the total (Figure 4).

In *Fantástico*, only 3 out of 16 (or 18.8%) stories showed images of scientists and research laboratories. In *JN*, 15% of stories

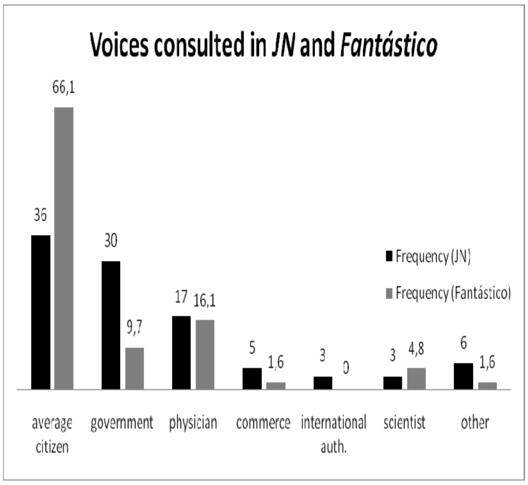

Figure 4. Frequency with which each voice type was consulted by Brazilian TV programs

(or 23) broadcast such kind of image. Contextualizing elements were present in a minority of the *JN* stories, that is, in only 10 out of 157: 3 mentioned the so-called Hong Kong flu of 1968; one mentioned the 1930s identification of a new H1N1 strain; one mentioned a past but recent political meeting; one talked about the emergence and spread of a new virus from Mexico to the United States, Canada, and other countries; one mentioned actions taken by the Brazilian government after WHO warned the world about a potentially pandemic flu; one mentioned the use of a homeopathic medicine to prevent dengue in one Brazilian state; one mentioned the Fort Dix flu outbreak and 1976 vaccination program in the U.S.; and one was about the 1918 pandemic. In *Fantástico*, contextualized information was found in only 2 of the 16 analysed stories. One referred to the 1918 and the 1968 pandemics of flu. The other gave some perspective to the emergence and spreading of A (H1N1) 2009 influenza.

Discussion

Both programs' coverage of A (H1N1) 2009 influenza was extensive and peaked in May, but *JN* coverage peaked one more time in July, when the new disease emerged and "re-emerged," respectively, after apparently declining in relevance in late May and June. The 2009 flu was no longer new but the growing number of cases contributed to the "re-emergence" of the disease as a public health threat.

The prevention or control measures, together with the growing number of cases of new flu and victimization from it, were the most frequent main topics found in *JN* coverage.

Regarding *frames*, the only two expressive ones in *JN* were containment and disease spreading/victimization, which fluctuated along coverage (Medeiros, Massarani, 2010). As Young, Norman, Humphreys (2008) remark, equal coverage of both frightening and reassuring information by the media at a similar time can make people "take longer to trust the reassuring information". Media coverage can contribute to raising people's levels of fear, concern, or anxiety, which is necessary to motivate actions leading to a reduction in risk exposure. However, it can also lead the public to take exaggerated self-protective measures or spread a pandemic of fear (Rubin et al., 2009; Fielding et al., 2005). *Fantástico* had disease spreading/victimization as the most frequently explored interpretive device; the containment frame was found to be as frequent as the personalisation/human interest *frame*, which refers to an effort to personalize, dramatize, or "emotionalize" the news (Semetko, Valkenburg, 2000)". Contextualized information was more often broadcast by *Fantástico* than by *JN*.

Scientific research had a minor role in both programs. Scientists represented only 3% of people voiced by the "hard news" program and 4.8% of the total of voices in the *infotainment* program' stories. In *JN* coverage, the most relevant sources used to construct journalistic stories were governmental representatives, physicians and international authorities. *Fantástico* also had sanitary authorities and physicians as the most frequently mentioned sources, but in contrast with *JN* the average citizen was more often used to construct the narratives. Physicians were also more frequent sources in the *infotainment* program.

The most common voices presented by *JN* were the average citizens, governmental representatives and physicians. In *Fantástico*, the average citizens were still more frequent. Our results indicate that sources and voices play distinct roles: whereas sources lend the stories credibility, voices, in turn, contribute to make the topics personally relevant to audiences (Kitzinger, 1999). Apparently, more than *JN*, *Fantástico* tried to create identification with ordinary people's lives and more fully explored the dramatic (sometimes tragic) potential of the disease spreading.

Fantástico seems to have privileged disease spreading due to the dramatic potential associated with information and images of infected and dead people. In the coverage of diseases or health risks, not only the "body count" is relevant: it is also important "who are at risk": threats to "people like us" tend to attract more attention than threats to "others" (Kitzinger, 1999). In the case of the 2009 flu, people with great dramatic appeal were among potential and real victims, that is, children, young adults and pregnant women. The potential impact of this kind of story cannot be neglected. Our results suggest that *Fantástico*, the *infotainment* program, can have contributed, more than *JN* to the amplification of risk perceptions regarding the A (H1N1) 2009 influenza. Whether *Fantástico* coverage could be said sensationalist, however, is a matter of debate.

Acknowledgements

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Science Blogs in Regional Languages: An Analysis

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Abstract. The number of Internet users in India has grown from a meager 0.3% of the total population to an impressive 7% over a period of 10 years from 1999 to 2009. With this rate of growth, the Internet, in its true sense, has become a mass media in India. Over the years, the Internet and WWW have been proving us with innovative tools for better and easier communication. Web logs, or blogs stand out among such tools. A blog, simply put, is a type of website. Blogs are usually maintained by an individual with regular entries of text, or other forms of information such as graphics or video. Blogging, for the most part, does not need any specialized computer skills, and can be accomplished using free services available online. Blogs are among the easiest ways to publish content online, involve zero or minimal cost of maintenance, and also provide readers the ability to directly interact with the writer through comments. All these features make blogs an effective medium for science communication. Further, in languages that have limited resources available in the field of science and technology, blogs offer an effective way of quickly creating and spreading content. The fact that the content so created will be freely available and also accessible through the search engines makes the usage of blogs further more attractive. This presentation analyzes an ongoing attempt in Kannada language of Karnataka State in Southern India, which uses a blog for science communication. Among the first of such attempts in the language, this blog called e-jnana (e-Knowledge) has been active for over three years now, and has clocked more than 8500 page views. It is expected that the analysis would provide insight into the role of blogging in the promotion of more interactive forms of science communication, especially in the regional languages.

Keywords: Science blog, Kannada, Blog

Researcher or Attention Grabber? Is Intellectual Property a Means to Communicate Scientifically?

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Abstract. Scientists and researchers have been using publications and Intellectual property as a means of scientific communication. But in an endeavor to protect their works they seem to be losing the essence of science. Science is a collective effort where the results obtained in one scientific exercise are used as the input for some other scientific production.

The author in this literary article intends to outline the paradox that the scientific world needs to solve. Is a scientific invention somebody's intellectual property that he/or she only has a right to deal with in a manner he/she thinks is appropriate or should the moral responsibility of a scientific mind be to share with all humanity without prejudice whatever science and nature reveals to us.

This paper briefly goes into the historical background of the Laws relating to Intellectual Property Right in the world and also in India in Particular. It deals with the question of the conceit of a scientist and how it hampers the progression of knowledge.

This paper also deals with what are the main motives behind engaging in scientific quest and what is the role of scientific communication in it. It deals with the insecurities of a researcher and the desire to get attention from the scientific community being the force driving the scientific communication today.

Keywords: Scientific pursuit, Intellectual property right, Intangible, WIPO, TRIPS, WTO

Introduction

Science (Latin word meaning 'knowledge') is the systematic knowledge of the physical or material world gained through observation and experimentation and 'Scientific pursuit' is a method of research in which a problem is identified, relevant data are gathered, a hypothesis is formulated from these data, and the hypothesis is empirically tested. But for a person wishing to gain scientific knowledge or trying to tread on a path of scientific pursuit it becomes imperative to gain a coherent picture of the sources and developmental stages of scientific ideas. Without this, 'Science' may seem to be a random collection of formulae and laws.

What nature reveals to us as scientific facts or the truths are put to productive use only when they are interrelated. Any person, may it be a student trying to gain some scientific knowledge or a researcher carrying on with some research activity can understand and appreciate the significance of this productive utilisation only when the various developmental stages and their interrelationships can be traced by him or her.

When a scientific mind or a number of them together create a new invention or come across a great discovery, there is definitely a great sense of achievement and pride associated with it. But along with this sense of achievement and pride there also sets in an element of insecurity. What if this great innovation or creation, achieved at an enormous cost in terms of funds, intellectual investments and human efforts, gets stolen or copied by somebody? Why shouldn't law permit him/her to safeguard this creation as his/her own property? Why can't this intellectual property be treated as an asset and purchased, sold, gifted or bartered as any other form of personal property?

The answers to all these insecurities of a scientist or researcher need to be addressed with great caution because of the intangible nature of intellectual property. It is this intangibility and perceptibility that sets apart intellectual property from other forms of personal property, and hence the requirement for some special laws and regulations. Intellectual property is a broad concept that covers several types of legally recognized rights arising from some type of intellectual creativity, or that are otherwise related to ideas[1]. Intellectual Property Rights(IPR) are rights to intangible things[2]—to *ideas*, as expressed (copyrights), or as embodied in a practical implementation (patents).This very idea of giving property rights over ideas, processes, inventions and other such scientific creations calls upon a debate on their moral justifiability.

Creativity requires a greatly varied and unrestricted public domain. Growth in science and technology is a cumulative process, with each new contributor working and developing his models and theories based on the inputs from the works of others who came earlier. IPR, in granting special rights over such intellectual property, not only grants ownership to the creator, it also awards a monopoly to him or her over his creation. This denial of the unrestricted public domain for creativity and scientific pursuit can immensely hamper the progress of science and technology.

Thus, the big Question the world of science and technology faces today: Is a scientific invention somebody's intellectual property that he/or she only has a right to deal with in a manner he/she thinks is appropriate or should the moral responsibility of a scientific mind be to share with all humanity without prejudice whatever science and nature reveals to us?

Intellectual Property Right: Historical Background

Globalisation has taken place at a rapid pace from the 19th century through the 20th and continues in the 21st century. This can be observed in the ever increasing flow of goods, investments and ideas across the international borders. Intellectual property which is the creative work of the human intellect, has also assumed importance throughout the world in the recent past.

The Historical Background of Intellectual Property Right can be traced as follows:

(i) Coordination of IPR at the international level started in the 19th century at the Paris and Berne conventions. These were combined in 1893 and the combined entity functioned under several names, the most recent being BIRPL (French acronym for United International Bureau for the Protection of Intellectual Property).

(ii) It became the main subject matter of the World Intellectual Property Organisation (WIPO), established in Stockholm on 14th July, 1967. WIPO became one of the sixteen specialised agencies of the UN in December 1974 and was responsible for taking appropriate action for promoting creative intellectual activity and for facilitating the transfer of technology related to the intellectual property to the developing countries in order to accelerate their economic, social and cultural development.

(iii) A landmark development in the international economic relations was the successful conclusion in 1994, of the negotiations on the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). TRIPS has now become a part of the legal obligations of the World Trade Organisation (WTO). Thus Intellectual Property has also become a part of the WTO- the only organisation dealing with the rules of trade between nations.

So, What is Intellectual Property and the Paradox?

The motivation behind the protection of Intellectual Property is to encourage and reward creativity. Statutory protection is given to the rights of a creator in his creation and also to the rights of the public in accessing these creations.

According to art 2 (viii) of the 'Convention Establishing the World Intellectual Property Organisation (WIPO) 1967', intellectual property includes rights related to (i) literary, artistic and scientific works; (ii) performance of performing artists, phonograms and broadcasts; (iii) inventions in all fields of human endeavour; (iv) scientific discoveries; (v) industrial designs; (vii) protection against unfair competition; and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields.

Intellectual property, from the point of view of communication in Science and Technology, is usually concerned with (a) Copyright, (b) Patents as Industrial Property. It becomes imperative here to understand the meaning of the above mentioned two branches and the controversies, if any, associated with both.

Copyright**:** The copy right act grants to the owner of copyright various exclusive powers like right to reproduce the work in any material form; to issue copies of the work to the others; to perform the work in public or communicate it to the public in any manner. The main objective behind laws related to copyright across nations should be to promote the progress of science and useful arts.

The Indian Copyright Act, 1957 provides that copyright shall subsist in a published work within the lifetime of the author until sixty years from the beginning of the calendar year next following the year in which the author dies. In a similar manner the Copyright Act of the United States of America which is largely based on the British statutes grants a copyright during the lifetime of the author and another seventy years from his death.

The question most crucial at this stage is that whether the State should have the power to curtail the exclusive ownership rights of an author, to a limited period? Why should his rights in his intellectual property not flow from one generation to the next, as is the case with his material possessions? Why should his children and grand children be deprived of their legacy sixty years or so after his death?

The only way this problem can be answered is by looking at the fact that the Copyright Act grants a monopoly where no such monopoly really existed. If Kirchhoff had taken a copy right on his Current and Voltage Laws, instead of introducing them as a foot note in one of his research papers, all the developments in Electrical technology would have surely got a severe setback. One has to understand that the Copyright is not a natural right but is a virtual right, created to give certain benefits to the author that work as an incentive to pursue the path of creative innovation. Expiry of this right should not be a deterrent in the process of acquiring and disseminating knowledge. But at the same time, it has to be kept in mind that the public or society definitely has a right to free trade and expression.

***Patents/ industrial property*:** Industrial property refers to creation of human mind in the form of inventions and industrial designs. Inventions here imply new answers to scientific and technological problems whereas Industrial designs refer to new appearances of industrial products. Patents provide an exclusive right to an inventor to use his invention for a certain period of time provided the invention (a new product or process) made is new or novel, involves an inventive step and has some industrial application.

Patents Laws were historically developed to give the inventor an appropriate share in the benefits from their inventions. This is done by giving the patent holder a form of exclusive control for 20 years from the filing of the patent. The Patent Law got extended to an array of inventions, over the 19th and 20th century. The originality required for an industrial design to be patented has become a questionable area. Till the early 20th century, plants being products of nature could not be patented. But the Plant Patent Act now provides a special form of patent protection and this has been extended to cover new and distinct sexually reproducing plant varieties. A patent was granted to a U.S company for a compound in the neem tree which is a native subcontinent. Its usefulness and free availability throughout India and its applications in traditional Indian Ayurvedic Medicine, agricultural and household use made it Gandhi's favourite tree. Now with such patents being granted, it is possible that Indian citizens may be required to pay royalties on the products produced from neem.

Patenting of any life form is unethical as it results in commoditization of life forms. Living organisms are products of nature but the judiciary by a narrow margin of five is to four changed this status when it decided that a strain of bacteria that were modified by insertion of new genes was patentable because it was not naturally occurring and was expected to be useful for cleaning oil spills. The patent granted to the "Harvard Oncomouse", the first animal to be considered an invention set up a trend towards patenting genetically modified complex living beings.

Patenting of human life in the form of human genes, cell lines and tissues is being defended on the basis of the arguments that products of nature once used to produce a form not possible outside of a laboratory should be patentable. The University of California was granted a patent for a cell line removed from the cancerous spleen of a leukaemia patient while the California Supreme court decided that he did not have a right to his own cells once they had been removed from his body.

Bioprospecting or collecting natural products is considered the latest in the field of science and technology. Biospectators keep looking for the rich genetic resources and the indigenous knowledge of the Third world and this result in the indigenous communities having to pay royalties for products based on plants and knowledge that actually belong to them. The bio resources are for common heritage of the mankind and cannot be allowed to be patented at any cost. That these resources are under constant threat from the developed countries was learnt by India the hard way when Suman K.Das And Harihar P. Cohli were granted US patent 540,504 on 28th March 1995 on the use of Turmeric as wound healer. The patent holders were Non-resident Indians and the Council for Scientific and Industrial Research had to fight to revoke these patents. Similar patents were granted to extraction and storage processes of neem ; to Rice Tecc Inc. on Basmati lines and grains by the USPTO which had to be fought by India

One dreads to imagine how the evolution of mankind and the story of civilisation would have suffered, had the person who first created fire by striking couple of rocks against each other decided to patent his process of producing fire. Aristotle believed, and rightly so, that the sense of property cannot exist without sense of liberty.

If one considers, ones intellectual property right acquired in the form of a patent ought to be perpetual and to be treated as sacrosanct, what happens to the liberty of others?

Conclusions

Though copyrights and patents seem to be property from the creators' point of view, they also restrict the concept of liberty from the society's point of view at large. Intellectual property is definitely different from the physical property and needs to be dealt with great caution. While protecting the rights of a scientist to the products of his labour and intellect and while providing an incentive for future investments and inventions, the Laws governing the Intellectual Property Rights should also allow the works to be made open to the public to be used with other new innovations for the benefit of mankind. Intellectual Property needs to be shared freely for the good of the society and hence needs to be put in the 'Public Domain' but at the same time, rights of the creators need to be protected. What has to be observed and respected is the line between overprotection and under protection and the classification of innovations and creative ideas that should or should not be granted this protection need to be done with great precaution and with only one purpose in mind and that is—Not to curtail the Rights of researcher by denying them the knowledge related to any developmental stage or depriving him or her the use of any earlier innovations that would help in their scientific pursuit . Let the tools of communication in science and technology be used for promotion of growth and betterment of science and technology and not to protect the conceit if a researcher or a scientist.

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References (and Notes)

1.In some European countries, the term "industrial property" is used instead of "intellectual property."

2.De La Vergne Refrigerating Mach. Co. v Featherstone, 147 U.S. 209, 222, 13 S.Ct. 283, 285 (1893).

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Reaching the People through Science Communication by Bridging the Gap between the Experts and Activists

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Abstract. Scientific discoveries and technological breakthroughs that hit the headlines make public curious about their implications. Experts and activists in the relevant fields have their own approaches and the public often do not get the information in the right language or with the right perspective from them. The science communicators are expected to reach people striking a fine balance between these two sections viz. experts and activists. But the lack of media encouragement and proper training remains a hurdle for quality enhancement in science communication. In a democratic set up science communicators play an important role influencing the policy framers also.

Keywords: Activists, Experts, Science communicators, Socio-cultural aspects

Introduction

India has a significant number of people trained in science and technology. But considering the overwhelming population the percentage of this people compared to the total number of people having basic education is really not that large. The society does enjoy the fruits of technology in a big way but takes interest towards science particularly the younger ones more as an attractive career option and not as an area worth knowing to take part in different social, cultural or political processes in a democratic society. People now come across newer technologies and innovations that often affect their lives with every passing day. Be it a new type of mobile phone or any other device, be it a new type of accessory fitted in a car for the reduction of emission of polluting gases or a new medicine, people get the fruits of research and adopt themselves with that. But the different aspects that include the socio-cultural and ethical as well as the commercial ones associated with the newly adopted technologies and innovations or research outcomes apparently do not attract attention of the common people. With the spreading of horizon of knowledge and fast emergence of branches and sub branches of different scientific disciplines it is becoming more and more difficult to keep track of the developments taking place in the research arena.

Newer areas are coming up where the new set of experts are taking the centre stage and are explaining newer observations and findings in a narrower field of study where vertical spread of knowledge is taking place in a big way. The experts, quite expectedly, try to stress on the rigor of the scientific information. This approach in the process does not give the people's understanding the topmost priority and the language or style of presentation often do not reach or touch the people in a big way. On the other hand we have a section of activists, not all, who know their agenda much better than the science and technology involved in the issues and often come up with a truncated or biased view particularly on the social, cultural or ethical aspects of the scientific and technological issues. The science communicator is expected to chart out her track through this by judiciously bridging the gap between the two approaches that sometimes may be referred to as contrasting.

The challenge of communicating science

A science communicator begins her work in this scenario where she finds the experts at the one end and the common people at the other. But the bridging the knowledge on one side and the views and opinions on the other side becomes a very challenging task because of several factors. It is true that the people on both sides who are interested in healthy discussion and exchange of observations not be very large. But the necessity of this exercise can only be overemphasized since whatever little information common people may collect likely to come from either of these two sources. Different innovations in science and technology nowadays affect the lifestyle, social and educational and even emotional set ups in an individual in a significant way. This may illustrated with an example. If we just look back to the introduction of the use of mobile phones in this country say about a decade back, some interesting things come to the fore. It was considered to be a rich men's 'ornament' and most of the people did not have the iota of an idea how this technology is actually going to govern the daily chore of a person however ordinary he or she might be in a very short span of time. Computers that have virtually taken an all-pervading role in our life entered the public domain barely fifteen years back. Now as it happens whenever this sort of technological innovations become parts of our lives different perceived aspect about them are highlighted, sometimes deliberately by different interest groups. One would be able to recollect that there used to be a lot of campaign against the introduction of computers in the manpower intensive sectors where people developed an alarming feeling that the computers would become the cause for their loss of job. The way different political groups and trade unions highlighted this aspect and tried to whip up some sort of neophobia among the common people indeed created a very strong case for the science communicators. The role of science communicator in such a situation becomes so significant that they can form the public opinion with the right perspective. Now people possibly agree that computers on the one hand became the cause of a few types of jobs while nobody could anticipate the huge type of jobs that it would create. In fact with the emergence of newer software and development of hardware and cost reduction in recent years are actually making the computers integral parts of life even in a not so developed society. The benefit of introduction computers in so many sectors has now actually reached the very common man in the form of railway reservation of ATM services offered by the banks.

The science communicator is expected to identify these areas and with the help of different forms of media can try to present the right scientific idea along with their possible implications, of course keeping in mind the social perspective. Science communicators normally come with the background of one or the other discipline of science but with the addition of newer ideas, concepts and innovations practically with every passing day their background even in a field where he or she had some basic training in her student days proves to be inadequate to comprehend a number of newer aspects. We have to appreciate the daunting task of the science communicators as a group of people who are acting as a link between experts and common educated section of the society.

Quality enhancement: The role of experts

A science communicator cannot see through the interesting aspects of different branches of science. It is also not possible for him or her to keep track of the vast load of information on science that is now available. Moreover it is indeed expected that the science communication should be context based to make it attractive to the readers, viewers or listeners depending on the medium. This section of the society may be identified as educated common man with interest but not much of knowledge in science. Particularly of we keep in mind that with the spreading of knowledge horizon very fast newer branches and sub-branches of different scientific disciplines are regularly emerging.

In a huge country like India interested population spread across the country cannot access the expert opinion on different issues directly. Not a very large section has the access to Internet of other modern facilities to enrich oneself even if there is a will. An interested citizen cannot attend popular or semi-popular lectures, discussions or talks on issues they are concerned in as most of these are confined to big cities or metropolises and sometimes remain out of bounds of the experts. That in a way entrusts a big responsibility on science communicators who can really communicate the views of the experts to the common man in a form and language that people understand. Quite often lots of ideas related to S &T make round in the society that needs to be handled in the right perception. For example, people come across occasional newspaper reports on the possible link between cancer and the use of mobile phones. Lot of campaign goes on in the cyber space with the circulation of forwarded e-mails that warn people about the special significance of a particular date etc. Most of these do not have any basis but the science communicators can actually present the experts' views after consulting them. If these views are non-convergent that also common people get a message that is worth studying.

The experts normally do not want to part with the views they hold as that is normally based on scientific rigor. That often makes their language and style of communication such that the common man finds it difficult to absorb. The science communicator's role lies here. He must have the right kind of scientific input from the expert if necessary through some structured questions and try to present the matter to the general public with the right perspective. He may add on his views and predict the future implications after judicial analysis. A close connection between the science communicator and the expert is so essential that there should be an international effort for maintaining this. For example the international bodies can think of developing a large pool of scientists, technologists, researchers from all over the world and they may be accessible through e-mail and other modes for helping out the science communicators in their pursuit. These experts may put up their explanations and views on different scientific issues to be made use by the science communicators.

Activists and non-governmental organizations (NGOs)

In India like in the rest of the world the NGOs are working in large number of sectors where they are supplementing the governmental efforts for the betterment of common man's life. So these fields among other things include 'scientific awareness campaign' involving environment, energy, health, and sanitation related issues. With due respect to a section of these activists who working under different NGOs this has to be mentioned that a much larger section of these people often try to sensationalize an issue instead of giving the right scientific input. Considering the background of these activists this is in a way is not surprising but their reach to the people particularly the younger people through school programmes cannot be ignored. They take up their work more as a routine duty and not as a commitment to the society. As such these efforts should be there to supplement what the experts or the government efforts are doing but often they tend to ignore the mainstream efforts highlighting their own. The use of nuclear power is a typical example in this context. The activists who are anti-nuke go on harping, sometimes exaggerating the evil aspects of the nuclear power. They often do not see anything positive about the nuclear power and this approach turns into a campaign and not a scientific deliberation. Let me stress that only a section of activists fall into this category. One can respect the commitment of an activist to a cause but he or she may not be the best person to learn about science from. Once again we need to look for a science communicator who on one hand may partially use the campaign materials but can come up with a balanced view with other inputs from the experts. This can then help our citizens to form what is known as informed opinion.

So a science communicator does need to maintain close link not only with the experts but with the activists as well. A science communicator needs to check what sort of inputs on a scientific issue has gone to the general public particularly to the younger generation through the campaign of the activists. Sometimes these campaigns come as some sort of a mantra or rhetoric without any explanation of the context. The campaign against the use of plastic and its different products is possibly a case in point. While the proper disposal of plastic bags or poly bags remains issue often this leads to a campaign of total elimination of plastic from the scenario. If the science communicator can actually help the activists putting more scientific content in their arguments along with their zeal a wonderful job can be done for the society.

Need for some initiatives

A few very important and relevant questions loom large particularly in the Indian context. What sort of qualification a science communicator is expected to possess since she is expected to deal with a formidable task in the present day scenario? Do the different media, electronic, print or audio employ or at least engage a science communicator? Is there any facility for imparting training to the youngsters who want to pick up science communication professionally or even as a part-time pursuit for the love of the area and work? Because of the non-availability of any satisfactory answer to question the ultimate question comes up; who would be a science communicator? Well, this is another gap that needs to be bridged if we want to have very responsible well-meaning people coming in and enriching this field.

It has been observed that a significant number of people involved in science communication are graduates in some branches of science. These people do put up efforts to upgrade them in science related information thanks to the Internet and world-wide-web. But it is also imperative that a single person cannot follow the interesting and critical developments taking place in different branches of science and technology. Or it is not possible to understand the significance of all the science related news hitting the headlines. The recent news of the LHC (Large Hadron Collider) is a case in point. And the role of experts in these situations is even more important. However we cannot deny that some basic training also needs to be arranged for the science communicators. Unfortunately in India, different Academies of sciences and engineering have not taken up this issue with the desired degree of seriousness. A few scattered efforts in a very modest scale have been observed but there need a lot of planning and once again the inputs from experts not only from the different fields of science and technology but from the people who help in developing writing and communication skills, people who can efficiently handle computers and possibly some serious readers. The exercise also demands the inputs from the policy framers who decide on the channelising the funds earmarked for the research in science and technology in the right direction.

Some well meaning organizations in different parts of the country run some training programmes for science communicators. Interestingly, they do not get enough participants who have pursued science up to the graduate level. There are commerce or arts graduates who read science up to 12th grade even occasionally up to 10th grade. Notwithstanding the seriousness and sincerity of these young people they must be put to some rigorous training so that they can take up their work of science communication in a bigger way. The database of the experts from the different fields has to be developed and maintained. These experts are expected to respond to the science communicator's queries and help them in communication the correct science. Since the profession of science communication has not emerged as a whole-time vocation with support from different sectors, the work is mostly undertaken by people who are actually associated with other professions for their bread and butter. So some support should be planned and organized for the quality enhancement of this profession.

Concluding observations

In India science communication has not been able to emerge as a whole-time vocation is spite of what is called electronic media boom. Moreover there is a reasonably large print media with wide reach that really does not much bother about science news. The English language media whatever material they publish or deal with take them directly from different international agencies and publish directly. So the Indian angle or implication to the Indian context remains unaddressed. The vernacular press does not show much interest about science. The science communicators actually work with this backdrop. So the motivation does not reach a very high level and their importance in the media sector remains somewhat tiny.

With the changing economic canvas and the impact of globalisation has brought in much better flow of money in scientific research in India. Projects involving large quantum of money is being sanctioned in different fields of research. In this democratic country the policy framers are essentially the elected representatives of the people. They actually need to gauge the people's mood while making different policy decisions including the sanction of funds for different scientific projects. Once again the science communicators can play a very important and significant role in forming the public opinion leading to the more accountability of the scientific community. This in turn makes the experts appreciate the need for communicating with the common people so that the inflow of funds remains in tune with their need. And this would lead to situation where the experts, activists and the science communicators will work in tandem supplementing each other and evolving the right environment of doing science with total involvement of the society at large.

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Science Coverage in Regional Newspaper: A Case Study of Two Newspapers from North East India

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Abstract. This case study is an attempt to examine and understand science coverage in newspaper from the geographically isolated North Eastern region of India. The study analyzed science stories published in one major English and one major Hindi language daily published from Assam during the month of May 2009. Dainik Purbodoy focused mainly on health (79%) whereas The Assam Tribune focused on health (39%) and environment (32%) related issues. Almost all the stories of Indian origin from both the newspapers were from Assam only, highlighting that the location of publication may influence the quality of coverage.

Keywords: India, Regional newspapers, Science coverage

Introduction

The spread of knowledge of science and technology is important as it not only creates awareness among common people about the latest developments but also may serve the purpose of solving some of the regional and local problems through proper dissemination of scientific information. Advancement in science & technology is reflected not only in the media itself but also in its functioning. Science needs different media for maximizing its reach. Public exposure to information is the first step in public understating of science. Media here can play an important role in dissemination of information and different time preference for various media consumption (Table 1) signifies that although the advent of advanced audio-visual media technology has affected but not diminished the preference for print media. A growth of 12.8% has been observed in the print of dailies from 2005 to 2008 in India[1] and till March 2008 there were 88,763 no of registered newspapers in India with highest number registered in Uttar Pradesh followed by Delhi and Maharashtra[2]. None of the states from the North East India featured in the top ten, although, North East India has 8 states comprising only 7.9% (2.62 lakh sq km) of the total geographical area of India. The region is characterized by poor infrastructure, difficult terrain, geographical isolation, poor socio-economic conditions and a low rate of growth but is one of the major biodiversity hotspots of the world. Assam and Sikkim are the only two states which bring out dailies in Hindi language[3].

Table 1. Time of media consumption (in %)

	TV	Newspaper	Magazine	Radio	Internet
Early morning to breakfast	5	33	7	18	2
Breakfast to lunch	6	38	21	18	21
After lunch	21	23	44	21	51
Evening until dinner	37	6	21	31	24
After dinner	32	1	7	12	3

Source. www.mruc.net

Global science coverage

This Scarcity of studies, which have tried to analyze science coverage particularly with respect to the newspaper being printed from North East India is the reason behind the present investigation. Few studies have tried to analyze the extent and behavior of science coverage in Indian newspaper[4,5,6] and they have concentrated mainly on English language dailies only. On average, Indian newspapers devote far less than one percent of the total printed space to articles and stories related to science and technology[4] though India ranks 12th in science and technology, with its global research publications share of 2.04%. Assam is Low Productivity State in S&T publication and ranked 19 of the 37 states & Union Territories of India. Top was

Tamil Nadu followed closely by Maharashtra and Delhi. Globally US top the list with publication share of 25.32% followed by UK, Japan, Germany, China and France (their global publication share ranging from 4% to 7.13%)[7]. Earlier studies have suggested very little science coverage in newspapers worldwide. Newspaper from UK, Greece, US and Australia devoted about 5%, 2%, 2% and 2.9% of the total space[8].

Methodology

English language dailies readership (18.59%) is second only to Hindi (27.54%)[9]. In some states like Chandigarh, Delhi, Maharashtra and West Bengal, the circulation of English-dailies exceeds that of Hindi-dailies. Based on the readership status, *The Times of India* (all editions) tops the list in English with 133 lakh readers and *Dainik Jagran* (all editions) in Hindi with 557 lakh readers[10]. The present study aims to study the Science coverage in regional newspaper from North East India. Two newspapers were selected for one month long study, *The Assam Tribune* in English and *Dainik Purbodoy* in Hindi -. Both the newspapers are published from Assam, *The Assam Tribune* from Dibrugarh and *Dainik Purbodoy* from Jorhat. These newspapers were selected because they are one of the major dailies of Assam in their respective language of publication[11]. *The Assam Tribune* completed 70 years in 2009 while *Dainik Purbodoy* though recently started has attained popularity in short span of its existence. The study was carried out for the whole of May 2009. The stories retrieved formed the subject matter for the present study. The stories were subjected to both the qualitative and quantitative analysis. The subjects of the news stories were identified from both the title and the contents. Each story was also categorized on the basis of its type of work it represented like research, reporting of events, general article etc. The data was analyzed in terms of space covered, geographical origin of stories, illustrations prominence of news etc.

Result and Discussion

The total number of items collected from both the newspaper was 88 with 42 in *Dainik Purvoday*, an average of 1.35 articles/day and 46 in *The Assam Tribune*, an average of 1.48 articles/day. A different publication pattern is visible when the number of stories was plotted against date (Fig. 1) during the study period. *The Assam Tribune* published more number of science items on lesser number of days ranging from 0 to 8 stories/day. On the other hand *Dainik Purvoday* published regularly with maximum frequency between 1 to 3 stories/day. Arya, 2007 observed an average of 1.2 stories/day/newspaper published in five English dailies from India which is comparable to the present investigation[6]. In another study Luisa Massarani et al, 2005 who studied electronically published science content of seven newspapers from Latin America (Argentina, Brazil, Chile, Ecuador and Mexico) found average stories published/day in the range of 0.8-3.6[12].

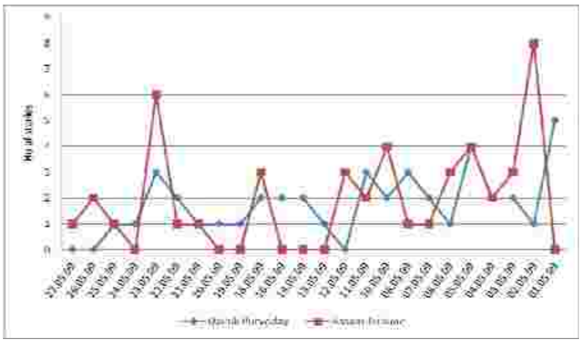

Figure 1. Datewise publication of stories

Knowledge Area

The topics covered were identified from both the title and the contents. A total of 12 different subject/areas were identified under stories during the study period (Table 2). The 46 stories of *The Assam Tribune* were covered in 8 areas whereas 42 stories of *Dainik Purvodoy* were covered in 9 of the areas. The dominance of different areas covered in both the newspaper is clearly visible from the table 1. The Hindi newspaper focused mainly on stories related to health (79%) whereas English newspaper covered both the health (39%) and environment (32%) related issues almost equally. About 13% (6) of the news story during the study period in *The Assam Tribune* dealt with biodiversity conservation and 4% (2) were related to animal behavior and science awareness. When compared 7% (3) of the news story in *Dainik Purvodoy* were related to Biodiversity conservation and all the three news were related to observing of some rare or extinct species.

Table 2. Topics covered in number (%)

Topics	*The Assam Tribune*	*Dainik Purvoday*
Animal behavior	2(4.35)	1(2.38)

Biodiversity conservation	6(13.04)	3(7.14)
Biotechnology	1(2.17)	-
Botany	1(2.17)	-
CSIR Technology	-	1(2.38)
Energy	-	1(2.38)
Engineering Sciences	1(2.17)	1(2.38)
Environment	15(32.61)	1(2.38)
Food & Agriculture	-	1(2.38)
Genetics	-	1(2.38)
Health	18(39.13)	32(76.19)
Science Awareness	2(4.35)	-

As far as the research publication is concerned Medicine, chemistry, physics, agricultural & biological sciences, engineering, biochemistry, genetics & molecular biology, and the materials science are the seven high productivity subject areas of research in India during 1996–2006[7]. This is reflected in a recent study of 31 English dailies where Dutt et al, 2008 observed that maximum number of items published were in the area of health, followed by environment, astronomy, biological sciences and space science and technology. These five subjects together accounted for 72% of the items. In another study Arya 2007 also found that content of five English newspapers was dominated by medical sciences related research news items[6]. Similar trend was also observed among Italian newspapers which was found dominated by biology and medicine accounting for more than half of all articles (52.7%) followed by engineering related items (14.7%)[13]. Massarani and Buys (2007) also found that medicine and health related stories dominated Latin American newspapers[14]. Similarly UK newspapers also seem to be dominated by health/medical. Other subjects which finding favour in UK newspaper are related to Environmental, biology and Technology[8]. At times phenomenal increase in an area of knowledge at particular time has been observed that may be attributed to the occurrence of certain incidences which lead to hyped coverage[12].

Experts/journalists

Misreporting of the science news at times by journalists emphasizes on the need for science graduates to take up journalism as career and increased contribution by the subject specialist. In the present investigation if we exclude the stories where no name or only the name of the writer without any affiliation is mentioned then overall only 3% (3) of the science based stories were written by subject experts. 'Natural disaster preparedness' by Former head of Geography, Gauhati University and 'Living with earthquakes' by consultant Engineer & Secretary, Indian Society of Earthquake Technology were the only two stories during the study period which were written by subject specialist. In contrast only one health related article in *Dainik Purvodoy* was written by a subject specialist i.e., Brig (Dr) Ved Chaturvedi, Director & Arthiritis Specialist, Sena Hospital, Guwahati. The data suggests that though the contribution by subject specialists like scientists, professors/faculty, health and engineering professionals etc is still negligent in regional newspaper and needs to be increased exponentially. In contrast, 17.1% of articles in Italian newspaper are written by scientists or doctors[13].

One of the main objectives of the present investigation was to highlight the contribution of science journalists and subject matter specialist to the science stories in the newspaper. It was observed that in the case of *The Assam Tribune*, 19% (9) were written by staff reporter or correspondent and in addition further 26% (12) carried the name of the writer taking the total contribution to 45%. In the case of *Dainik Purvodoy* only 7% (3) of the stories had the name of the writer mentioned whereas further 5% (2) were written by staff reporter or correspondent. There was writer's name/source of stories mentioned in 88% of the stories in the *Dainik Purvodoy*. It is not possible to draw conclusion based on the name alone whether the writer is journalist or specialized science writer. To get a clear data further investigation involving communication with the newspaper/writer is required which is the limitation of the present study.

Presentation Style & Illustrations

Both the newspaper showed marked difference in the presentation style of stories covered. The presentation styles were categorized into research based news, general article, interview, reporting of an event (seminar/conference/workshop etc), new product/technology developed *etc* (Table 3). The

Dainik Purvodoy predominantly covered research based news (73%) followed by 14% of stories written in the form of informative article whereas in *The Assam Tribune* 43% stories were written in informative article manner followed closely by 32% research based stories. A clear difference can be seen that about 17% of stories in *The Assam Tribune* reported the occurrence of events like conference/seminar/workshop related to health or S&T which is clearly absent in *Dainik Purvodoy*. Less than 5% of the stories in both the newspaper were interview related to new product/technology. Easy availability and reliability of journal publication to highlight the recent scientific discoveries may be the reason behind very high percentage of research based stories 73% in the *Dainik Purvodoy* and 43% in *The Assam Tribune*.

Table 3. Presentation style in No (%)

Type of story	The Assam Tribune	Dainik Purvoday
Article	20(43.48)	6(14.29)
Event reporting	8(17.39)	-
Interview	2(4.35)	1(2.38)
New product/technology	1(2.17)	2(4.76)
Photo	-	1(2.38)
Press Meet	-	1(2.38)
Research based	15(32.61)	31(73.81)

To appeal to the readers catchy headlines and illustrations are often used. This was proved true in the case of *Dainik Purvodoy* where 78% (33) of the stories had some illustration. Of these 72% had photographs and 24% had cartoon. The remaining 3% had combination of both the photograph and cartoon. On the other hand *The Assam Tribune* science stories lacked illustrations with only 9% (4) having any visual. Overall more than a third of the stories carried some illustrations. On average more than fifty percent of the Indian English dailies used some form of illustration whereas in the present study about 42% of the stories from the regional newspapers used illustrations. Rooyen also observed that the daily newspapers in south Africa used maximum amount of infographics while none of the science stories in the regional newspapers used infographics[15].

Geographic origin

The information regarding the country of origin of the event or activity of a story could be traced in respect of only 82 stories (Table 4). The origin was identified from the content of the stories. These 82 stories had their geographic origin from seventeen different countries, of which 61% from *The Assam Tribune* and only 17% from *Dainik purvodoy* had their origin in India. All the news from India had their origin from Assam only, not even single news was from other North Eastern states or from the rest of India. As far as science for outside India is concerned *Dainik purvodoy* covered 33% of news originating from USA followed by Australia (12%).

Table 4. Geographical origin of the stories

Country	The Assam Tribune	Dainik Purvoday
Australia	-	5(11.90)
Bangladesh	1(2.17)	-
Belgium	-	1(2.38)
China	-	1(2.38)
Denmark	1(2.17)	-
England	2(4.35)	4(9.52)
France	1(2.17)	-
Germany	-	1(2.38)
India	28(60.87)	7(16.67)
Kenya	1(2.17)	-
Netherland	1(2.17)	2(4.76)
Norway	1(2.17)	-
Russia	2(4.35)	-
Scotland	-	1(2.38)
Spain	1(2.17)	-
More than two countries	-	2(4.76)
USA	5(10.87)	14(33.33)
Not given	2(4.35)	4(9.52)

Italian newspaper published almost identical equal number of science news with content referring to United States and Italy[13]. National science in the Latin American newspapers found lesser space than scientific results from developed countries[14].

Prominence of news

The placement of a news story in a newspaper indicates the importance accorded to the story. News are categorized and placed in specific sections like national, international, science and technology, sports, entertainment, etc. The study revealed a set pattern of placing of the S&T and health related stories in the Hindi newspaper. Over 85% of the stories were printed on the 12th page which is also the last page of the newspaper. Of the remaining, 7% were printed on the 3rd page. The placing shows that the newspaper has a clear preference of placing the S&T and Health related news stories together on a fixed page. Occasionally the stories were placed on the other pages. In case of *The Assam Tribune* almost equal percentage about 20% of stories were placed on page 6 and 12 followed by 10% on page 5 and 8. Not a single S&T or health related story found space on the first page of *Dainik Purvodoy*. On the other hand *The Assam Tribune* published 2 stories on the first page both written by Sivasish Thakur and both involved present day issues. One was on encroachment in the forest and the other on urbanization. To become front page news science stories have to compete against political news.

News Sources and quotation

Overall 63% of the stories had quoted someone. The individuals being quoted included scientists, university faculties, subject matter experts, high level institutional officials etc. Remaining 3% quoted either 2 or 3 people. When compared overall *The Assam Tribune* had quoted someone in 59% of stories as against 69% of *Dainik Purvodoy*. On further analysis it was observed that majority of them (97%) had quoted a single source (70% in *The Assam Tribune* and 90% in *Dainik Purvodoy*). The remaining 3% had quoted either two or three sources. In order to confer credence and an air of authority to their stories the newspapers tend to quote eminent people and organizations to authenticate the news[5]. While sources used determine the way issue is framed, often it is in the hands of the journalist to choose the sources[16].

Use of news agencies has become a common practice to obtain mostly the news from outside the country on regular basis. Overall only 16 science stories had been sourced from different news agencies/services (Fig. 2) and all of them were from *The Assam Tribune*. Of the 16 stories *Press Trust of India (PTI)* contributed maximum (56%). Other sources included A*gence France-Presse (AFP)*, IANS, etc. None of the stories in the *Dainik Purvodoy* under the study period mentioned any news agency or service provider's name.

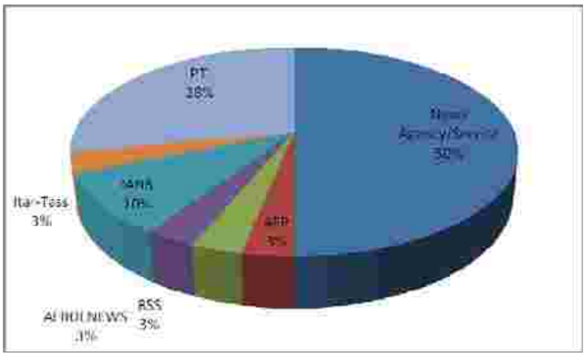

Figure 2. News agency for stories published in The Assam Tribune

Conclusion

Though science is there in every aspect of our life yet the continous lack of not only front page science news but also occupying very little space in the newspaper highlights the fact that science has yet to find favour by the editors as well as journalists and writers if we are to create awareness among the common man. The study highlighted that contribution of subject experts is negligible in regional newspapers. An indepth, comprehensive and long term study is required to analyze the reason behind this.

Allotment of the space for coverage of science news in dailies, be it national, regional or local, depends largely on the mindset of the individual publishing group of such dailies. In such a situation, in the greater interest of the well-being of the society, the government may also think of imposing statutory obligations on the publication groups for increased science coverage. Instead of relying too much on foreign news agencies for domestic science coverage, we have to create our own science news agencies in order to make it more need based and also with a view to avoid hyped coverage. Since there is dearth of studies which focused on the science coverage in Indian print media especially with reference to the regional influences the authors sincerely hope that the study will incite other researchers to take up in depth studies for better understanding of the lacuna in the science dissemination and public understanding.

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Information, Communication Technology in Agricultural Research at DIPA Portal

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Abstract. The Indian Council of Agricultural Research is deluged with information through research journals, periodicals, scrolling news on ICAR website, database, etc. The huge volume of information is generated at ICAR research centres, institutes and State Agricultural Universities that is required to be managed and Directorate of Information and Publications of Agriculture (DIPA) does the same work. It collects information and communicates to farmers, scientists, research workers, students etc. The communication system of DIPA has a source of information as research centres, institutes and state agricultural universities which are mainly originator of message; the communication channel i.e. print and electronic media through which message is conveyed; and complete team of scientific-skilled personnel who receive information and convert it into knowledge. Since March 2010 the ICAR has approved Open Access Policy, and all its journals, periodicals, in-house journals, catalogue of books, circulars, etc. in English as well as Hindi are available on icar.org.in.

The present paper deals with the network of existing information resources, together with news services for identified gaps so coordinated as to reinforce and increase the activities of the individual units and thus enables specific categories of users, viz. research oriented workers, farmers, students etc. to receive the information in form of journals, periodicals, in-house journals, etc. to receive the relevant information to their needs and abilities. The paper has discussed Information system and role in DIPA, components of information systems, DIPA portal on ICAR web site, fast communication with the referees and authors through newly developed soft ware under a NAIP project, ‘E-publishing and Knowledge System in Agricultural Research’. The advantages of this project include negligible investment by the author; short duration in communication with the referee/author; once accepted manuscript is published in short duration and is also made available on DIPA portal/ICAR web site. Already published contents can be secured by developing digital archives. This project viz., ‘E-publishing and Knowledge System in Agricultural Research’ has been funded by the NAIP, ICAR for establishing an e-publishing system for the open access of the e-journals/e-periodicals etc. Besides it also provides opportunity to do knowledge management of the experts of the different disciplines viz. Agricultural Sciences, Animal Sciences, Fisheries, etc. Once this project is completed it will bring a revolution in the Agricultural Information Technology.

Science Communication through Mass Media

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Abstract. The earliest origin point of the science communication can be marked when the man invented the fire kindling technology. Then slowly he prepared himself to draw the cave paintings. The invention and dissemination of fire kindling technology is considered as first science communication. Now we are in digital age. This digital is also called as Entertainment Age. In this age only the science communication shifted from the elite people to common forum. This shift is due to the media revolution in India for last two decades. Today media play the role of–to educate, to entertain and to inform sensitively. The first role of media is mostly done by special interest magazines. In those farmers's magazines, science magazines have a great role to educate the society. In Tamil Nadu, Ananda Vikatan is successful running magazine for more than 80 years. From Vikatan's publication a farmers's magazine called Pasumai Vikatan. The readers of this Pasumai Vikatan magazine are mostly farmers. The purpose of the present study is to find out the coverage of agriculture news in Tamil magazines. This research addressed the following questions. What is the extent of agriculture coverage in Pasumai Vikatan? What are the content characteristics of agriculture content in Pasumai Vikatan? What is the style of coverage in Pasumai Vikatan?

The present study employed qualitative content analysis to study the coverage of science in Pasumai Vikatan. The sample period chosen was between 2007 and 2009. The researcher used non probability sampling method for sampling issues. By employing available sampling method, the researcher collected 18 issues. The magazine purely dealt with the agriculture. The magazine became the hand guide for the farmers. For example, the 'Magasool (Harvest)' seriously deliberate the information for harvesting various crops. 'Tandora' another part of magazine help the readers to intimate the various conferences and workshops that will held at various parts of country. 'A Chat under Tree' is a conversation method of discussing the advantages and disadvantages of tools and techniques used in agriculture. And also the magazine is interested to publish all the aspects of farming. It also acts as a guider to compare the modern techniques with the old one. The colorful photographs with the scientists interview add more essence to the magazine.

A National Policy on Science Popularization of Tremendous Weight

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Abstract. There are many ways of the study on policies in terms of science and technology. Some argue the importance of policies, some point to the process of policy making and the lack of reason in bringing out sound policies, and still some make brief introductions to the available ones (most of the time they lay there for the 'snookers' to approach by themselves). Many countries have produced kinds of policies in the field of science communication but it is rarely seen up till now detailed analyses of them that may help people beyond the boundaries to well understand what they are, which is absolutely an inconvenience for the colleagues in the circle to get understood each other. Policies are decisions of decision makers. They are important because they represent the will and intention of the power, they try to secure the course of the enterprise in their countries with sort of carrot and stick, and once they are put into effect they might change that part of the world. For these reasons, the paper tends to try lifting the veil to look into this piece of appealing domain, by introducing, also briefly, to the Outline of the National Scheme for Scientific Literacy, a very important national policy on the state level now governing the practices in the field of science communication in China. This short presentation will be divided into three parts: (1) The background and the formulation of the policy. There are also two peeping pipes to look into the issue. For background part, we can see the need to produce such a policy is both of domestic pull and exterior push. The policy was enacted in 2006. It was a time when China was running fast in managing its economic and social progress. High quality citizens are needed. Beside that, the idea of produce such an ambitious scheme was also encouraged by the USA 2061 project and some else. For formulation part, the process of producing the policy was carefully designed starting with small group studies of a dozen of focused topics bonded in a package. Rounds of rounds consultative discussions and seminars were organized. The working pattern reflects the influence of the current global practice. (2) The structure of the policy. Goals are set in phases. The guiding principle is clear while demonstrating Chinese value and understanding of the thing that is called science popularization, or science communication, whatever. Target citizens are divided into four groups: farmers, working population in urban areas, youngsters as well as leaders and public servants. In securing the effect, four projects are fixed up in priority. (3) The effect of the policy. Four years have passed since the announcement of the Scheme. Efforts invested began to yield fruits. Science-based governmental organizations are requested to engage themselves in coordination, social sectors are mobilized, scholars are encouraged and social resources are integrated in various forms. China never sees an action in such a magnificent scale. Yet there are still some areas are left in the dark. Measures will be taken in the next five year plan.

Keywords: national policy, science popularization

2009–The International Year of Astronomy: How Did It Go And What Did We Learn?

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List of invited speakers

- Ranjeev Misra, Inter-University Centre for Astronomy and Astrophysics
- Kevin Govender, South African Astronomical Observatory/Developing Astronomy Globally
- Kimberly Kowal Arcand and Megan Watzke, CfA, Harvard/From Earth to the Universe

Abstract. In 1609, Galileo turned his telescope–then recently invented–towards the sky above him. What he saw amazed him and led him openly to question the then-prevailing teachings that the Earth was at the centre of the universe and that, above the near-Earth environment, the heavens were pure and unchanging. Moreover, Galileo's observations and his interpretations of them opened up every received dogma about the natural world to critique based on *personal* measurements and *personal* reason. To mark the 400th anniversary of that system-shattering event, the International Astronomical Union organised the 2009 International Year of Astronomy (IYA2009) under the theme "*The Universe, Yours to Discover*".

Many spectacular initiatives took place during 2009 and early 2010, from the twelve global Cornerstone projects to the thousands of national activities where millions of people got involved in astronomy-themed events. Citizens previously unaware of astronomy became involved in this most democratic of sciences in vast numbers. Activities ranged from star parties to street parades, touching old and young alike. Take, for example, the two worldwide star parties "100 Hours of Astronomy" and the "Galilean Nights" where more than 3 million people got involved with many citizens seeing night sky objects through a telescope for the very first time; the Indian astronomers proudly showcasing their work at the Republic Day parade in Delhi, where around 30.000 people participated; or the Guinness World Record 4.8 km-long canvas painted during the astronomy-themed Oceans Festival with more than 300,000 participants in Portugal.

But how was the celebration of an essentially western, essentially European, "scientific revolution" received across the globe, with its various social and cultural environments? Making use of the experiences of European, Indian, Brazilian, Korean, Japanese, etc experiences, this session will look critically at the experience of IYA2009. It will describe some of the events that occurred, their reception and what astronomers and science communicators have learned from their experiences.

(Scientists in Popular Culture: Between Stereotypes and Celebrities)

Science Communication Through Mass Media

Presenters
Massimiano Bucchi, University of Trento, Italy
Richard Holliman, Open University, U.K.
Declan Fahy, American University, United States

Overview. This seminar presents the findings of original research projects that have explored some of the diverse and complex ways in which scientists have been portrayed in contemporary popular culture. The papers offer unique, but complementary, analyses of scientists' fictional and non-fictional representations in a variety of different mass media formats, genres and cultural contexts. The seminar examines how images of scientists are disseminated, described, constructed and contested, not only in journalism, but in other cultural forms, including animated cartoons and popular science books, through which audiences encounter and engage with scientists and scientific ideas.

In their work, the presenters have used diverse methodological approaches and theoretical frameworks. Massimiano Bucchi explores, through mass media coverage of Nobel laureates, two contemporary trends in the communication of scientific information: the proliferation of journals disseminating results, on the one hand, and the concentrated attention given in particular journals to a limited amount of eminent scientists, on the other. Richard Holliman presents work that he and colleagues have undertaken to examine images of scientists in animated cartoons shown on children's television, finding that these forms retain at least some of the stereotypical imagery that was evident in the 1950s. Declan Fahy explores ideas about scientific fame through an analysis of three contemporary British scientist-authors, recontextualising their popular representations using approaches from emerging theories of celebrity.

The seminar aims, through presentations and discussion, to draw comparisons and contrasts between scientists' portrayals in these different cultural forms. It aims also to provide original insights into the contemporary representation of scientists in popular culture to a range of audiences.

Keywords: Scientists, Mass media, Representation, Popular culture, Television, Nobel laureates, Animated cartoons, Celebrity

Paper 1

Imagining Scientists: Exploring Stereotypical Representations of Scientists in Animated Cartoons for Children

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Abstract. For more than 60 years researchers have explored stereotypical images of scientists. During this time they have attempted to isolate the small number of essential, simplified criteria that represent a scientist. This work began in the 1950s when two cultural anthropologists, Margaret Mead and Rhoda Métraux, drew on the perceptions of American high-school students to produce a composite image of a 1950s scientist, combined with a number of positive and negative characteristics. Their findings, published in the journal *Science*, described a stereotype that still features in some forms of popular culture.

Why does the stereotype of an aged, hirsute, bespectacled, disheveled and clumsy smale scientist endure in some forms of popular culture, and in spite of the considerable efforts to challenge and replace it with more authentic images of what 21st century scientists actually look like and do? And are alternative 'types' of scientists emerging to challenge the 1950s stereotype? How do these emerging types differ from the stereotype identified by Mead and Métraux? Importantly for those concerned with perceptions of science in the public sphere, how do people, particularly young people, respond to images of scientists? To what extent do these images influence the self-concept ("what I perceive myself to be") and self-efficacy ("what I

believe I could and would like to become”) of young people in how they perceive the sciences? Do children and young people have the media literacy skills to deconstruct stereotypes and respond to them in ways that are relevant and useful to their perceptions of the sciences? We explored these questions in a project called Invisible Witnesses (open.ac.uk/invisible-witnesses).

In this paper we explore representations of scientists from UK television, focusing on animated cartoons produced for pre-school and school-age children. We document the use of symbolic codes and characteristics to represent scientists, and study how the roles attributed to scientists relate to issues of gender. The findings indicate that there are an increasing number of ‘types’ of scientists represented in animated cartoons on children’s television, with more women scientists appearing. However, the symbolic codes attributed to the 1950s stereotype are also routinely deployed by the media professionals that produce animated cartoons. Our research also found that children and young people have sophisticated media literacy skills. They easily differentiate between fact and fiction. And they have the skills to deconstruct stereotypes and imagine themselves as scientists, even if this is not their selected career path. In conclusion, we argue that animated cartoons could represent scientists more accurately and authentically, and that children and young people, as well as scientists, could usefully contribute to the process of developing characters for these series.

Paper 2
Star-System and Long Tails: Contradictory or Complementary Trends in Science Communication?

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Abstract. Communication of scientific results seems today to be shaped by apparently contradictory trends. On the one hand, fuelled by the proliferation of journals and the diffusion of digital journals, the ‘tail’ of available contents gets longer: there is more and more space for an increasing number of contributions, however specific and targeted to small niches in terms of audiences. On the other hand, substantial recognition and visibility appear more and more concentrated within a limited circle of journals and scientists that are the equivalent of blockbusters in markets like music or cinema.

The paper will explore the connection between the above dynamics and growing proximity between scientific research and the mass media, highlighting how the ‘Matthew Effect’ described by Merton (1973) gets amplified under the pressure of research institutions’ public relations and through increasingly frequent short-circuiting between science and communication. Thus, science becomes subject to a star-system logic which is not so different from the logic of sport or show business: scientists who have become familiar to the broader public turn into powerful ‘brand’ currency which can be ‘spent’ in a variety of situations. The case of Nobel laureates will be explored in this light.

Paper 3
Hawking, Dawkins and Greenfield: Case Studies of the Celebrity Scientist

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Abstract. At the end of the twentieth century, a group of British scientists emerged as high-profile researchers, authors and public intellectuals. *Vogue* magazine in 1997 called them the “pop scientists of the 1990s” and they were protagonists in what *The Independent* called in 2001 “an age when science [was] dominated by its media superstar authors”. These scientists became well-known outside their scientific fields, their marketed books becoming bestsellers, their talks packing out literary festivals, their opinions being described and dissected in mass media publications as diverse as *The Times* and *Hello!*

But what is a superstar scientist? What are its essential features? Is scientific fame different from sporting, literary or filmic fame? This paper addresses these questions, exploring

the phenomena of the celebrity scientist, defining its central characteristics, explaining the process of its creation and describing its social role. It does this through an analysis of three scientists: physicist Stephen Hawking, author of *A Brief History of Time* (1988), the highest-selling popular science book ever published; evolutionary theorist Richard Dawkins, author of books including *The Selfish Gene* (1976) and *The God Delusion* (2007) and the UK's first Professor of the Public Understanding of Science; and neurologist Susan Greenfield, former director of the Royal Institution and author of books including *The Private Life of the Brain* (2001) and *Tomorrow's People* (2004).

The paper, using novel approaches from the emerging field of celebrity studies, argues that these three scientists are represented in mass media as celebrities. They share characteristics with famous writers, politicians, film and sports stars, characteristics including their representation as unique individuals whose public and private lives merge, their commodified image being bound up with promotion, and their persona embodying abstract values, ideas and ideologies.

The three subjects also share characteristics, this paper argues, with iconic historical scientists, including Isaac Newton, Charles Darwin, Albert Einstein, Fred Hoyle and Carl Sagan. It examines how the distinctive image of each celebrity scientist has been fashioned through a combination of the subjects' own writings and television work, their interviews and profiles, their intertextual representations in fiction and non-fiction, and a linking of their work with recurring concepts in the history of ideas. The paper argues also that the subjects have come to represent the strongly mediatised and commercialised character of contemporary science.

National Strategies for Science Communication: Comparing International Approaches

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Abstract. This paper presents four contrasting national strategies for science communication, representing Australia, China, the United Kingdom and India (the last of which is still under development). The three published strategies all involved broader consultations as well as government and high-level strategic input in their development. All the strategies focused on both public and policy-related audiences, and shared many common action points such as providing training and improving the infrastructure and sharing of resources for science communication. There were however some differences in their scope and focus, mainly arising as a result of economic, cultural and social differences between the countries.

Keywords: National strategy, China, Australia, UK, India

Introduction

As the benefits of science communication have become more apparent, governments around the world have begun to implement processes to develop far-reaching national strategies for embedding science communication into wider practice. There are often similarities in the challenges being addressed by different countries, for example decreasing interest in science within the population (especially for pursuing a scientific career) and reduced funding for scientific research. These issues are particularly apparent in the USA, the UK and parts of Europe in recent times, with reduced funding partly due to economic downturn in those regions, whilst other countries (such as China and Australia) have seen a surge in science-related R&D investment by central governments. The approaches taken by different countries therefore often differ in their scope and implementation, reflecting both national cultural differences as well as potentially different science communication ideologies.

This paper briefly compares the strategies implemented by four contrasting countries: China, Australia, the United Kingdom and India. Each national strategy is briefly introduced, followed by a comparison and analysis of the key similarities and differences between the four strategies.

China

The *National Scheme of Scientific Literacy for All*[1] was launched in 2006, as a long-term strategic action plan to make China into an innovation-driven country. In order to realize its objectives, the State Council asks government at different levels to raise their inputs and provide policy support on: 1) science education and training, 2) scientific museums and related facilities, 3) resource-development for science communication, and 4) capacity-building of science communication by mass media. The implementation of the *Scheme* relies on an alliance of ministries, academies, as well as non-governmental organizations during the last five years.

Australia

The *Inspiring Australia*[2] report proposes a national strategy for public engagement within

Australia that will help realise government goals related to innovation and scientific development. The strategy encompasses a more coordinated approach to communicating the sciences across the country, and was developed through a series of national consultations with a wide range of science communicators, educators, journalists and scientists in all states and territories.

United Kingdom

Following a consultation on Science and Society, the UK Government set up the Science for All Expert Group to develop a national Action Plan[3]. Three challenges were identified: gaining a wider understanding of why, when and how the public engages with the sciences; developing supportive networks and mechanisms for increasing effective engagement; and encouraging a professional culture that values, recognises and supports public engagement. Many organisations are committed to deliver the plan together, working informally and with Government support.

India

The first Prime Minister of India, Pandit Jawahar Lal Nehru presented the Scientific Policy Resolution on March 4, 1958, which has been a guiding factor for development of science and technology in the country. Special attention was given to the scientific approach and communication in the resolution, which has been a basis for various policy and strategy documents since. For example in 2003 the government of India announced a comprehensive *Science and Technology Policy 2003* that carried a section on 'Public Awareness of Science and Technology. However to date there is not a single defined strategy for the entire country. The NCSTC (National Council for Science & Technology Communication) is currently under way for formulation of a document.

Comparison and Analysis

Taking the four national approaches outlined above, a brief synopsis of their key elements is provided below. For ease of comparison this has been broken down into four fundamental areas: the motivations behind the development of the respective strategies (including their stated objectives); what processes were involved in their development and how far they have progressed in their delivery to date; who the priority target audiences are within each country; and finally a comparative analysis of the scope of the action points and/or recommendations contained within each strategy.

Motivations and objectives

All four countries demonstrate a consistent desire to improve both *levels* of recruitment ('capacity building') and the *skills* of those recruited to science and technology (S&T) roles. Within certain countries (e.g. Australia) there is explicit recognition that without wider acceptance of S&T amongst public groups (not just those who become scientists) this recruitment will not be possible, although this is implicitly recognised within other strategies also. The Australian and Chinese governments have both identified clear priorities relating to driving 'innovation' within their countries, which also comes into play in their science communication strategies. In addition to the 'public' oriented audiences, the Australian approach also aims to achieve improved links to policy, and an 'open relationship' between science and society. China also includes policy makers and public servants as a key focus (see 'Target Audiences' below). In the UK the orientation is further extended to recognising the potential impacts on the researchers involved in science communication – that there are benefits to science as well as society – and a key focus is to 'ensure that public perspectives are sought, recognised and responded to by the scientific and policy committees'.

One interesting area of contrast is the different definitions and language used within the respective strategies. In particular, both Australia and the UK use very broad definitions of 'science', for example in the UK this is stated as 'encompassing research and practice in the physical, biological, engineering, mathematical, health and medical, natural and social disciplines, and research in the arts and humanities'. Whilst most of the other strategies talk about 'science communication' or 'science engagement', the Chinese strategy refers explicitly to 'science popularization' - a historically preferable phrase in China referring to the prevailing cluster of concepts such as science communication, PUS (public understanding of science), scientific culture, etc. In the UK, the term 'public engagement' has largely taken over. It is seen to include ideas of science communication and public understanding but additionally covers a wider range of purposes and types of activity between scientists, policy makers and the public.

The stated objectives within each national strategy reflect strongly on cultural and social norms within the country in question. For example, in China efforts to improve scientific literacy take advantage of the lead role played by the government, aiming to ‘promote a full-fledged economic, social, human development, to improve China’s independent innovation capacity and overall national strength, and to create a solid workforce foundation for building a moderately prosperous society’. In the UK, where government is less central to everyday life, there is a stated intention to ‘deliver a shift in cultural awareness, recognition and support for science’. The focus is on improving the cultural role of science rather than how well it is understood by public groups. In contrast, in India, where average GDP is much lower, and more basic needs come into play, the focus of the strategy currently being devised is towards the ‘improved wellbeing of citizens and saving and shaping their lives’.

Development and current status

In line with existing good practice within the field, all three of the existing strategies have combined a central ‘Expert Group’ (UK) or high level steering committee (Australia and China) with some form of wider consultation with key stakeholders in order to ensure that the resulting strategies were relevant and useful to the people they would impact upon. In most countries there has also been recognition of the importance of research evidence.

The approach in China represents the current phase in a series of schemes to improve S&T popularization. The process of producing the policy was carefully designed, starting with small group studies of a dozen focused topics bonded in a package. Rounds of consultative discussions and seminars were then organized to produce the final version. The *Scheme* is designed to be completed in two phases, the first from 2006 to 2010 and the second from 2010 to 2020. Specific goals are set respectively as short-term and long-term perspectives.

In Australia the impetus was provided by a recent (2009) 25% increase in spending by the Australian Government on science. This increased focus led to recognition of the need for the development of a national communication strategy. The steering committee contained representatives from the media, Questacon (Australia’s national science and technology centre), government-funded research organisations, the Office of the Chief Scientist and the relevant government department. More than 230 people were involved in the wider consultation, including science communicators, educators, journalists and scientists in all states and territories. Since the release of the *Inspiring Australia* report, the Australian Government has committed to implementing the strategy contained therein, and initial planning is underway for implementation including the development of a framework of principles of science communication initiatives, establishment of coordinating groups and networks and progress on campaign branding.

In the UK the strategy development took the form of a major public consultation on Science and Society by the Government, one result of which was the setting up of the aforementioned Expert Group to coordinate a coherent national approach to resolving the issues identified in the consultation as well as celebrate and disseminate recognised successes. Separate groups were set up to investigate ‘Science and the Media’, ‘Science and Trust’, ‘Science and Learning’ and ‘Science for Careers’ in addition to the ‘Science for All’ group which produced the Action Plan described here. Since the Action Plan was published a follow-up group has been established to further progress the identified action points, with regular public updates as the work continues.

Although not yet in a publicly accessible form, the Indian approach differs most significantly through its focus on field projects involving people on the street and grass-root level. The thrust in early post-independence India was on scientific temper and science education, formal and informal and science communication was mainly centered on publication of books and magazines, etc. The interest was triggered generally in the 60s and 70s in agriculture, space and programmes on the radio began because of the green revolution and space expeditions. The decades of the 80s and 90s witnessed a shift from indoor communication to outdoor science communication channels, such as Vigyan Jatha and use of folk media. This grass-root focus is continuing in the current developments of a national Indian strategy.

Target audiences

Only the Chinese *Scheme* identifies explicit target audiences to date, although the intended recipients may be readily inferred from the strategies outlined within the other countries. Within China the focus is on improving the scientific literacy within the following four groups:

- Young people
- Farmers
- Working population in urban areas
- Leaders and public servants

The first group clearly links into the focus on recruitment and capacity building, and is shared amongst all four nations. 'Farmers' and 'working populations in urban areas' are more unique to the Chinese cultural situation, since there are distinct differences in scientific literacy between urban and rural populations which are less apparent in other countries. Farmers in particular are identified as a key group due to their potential role in 'ecological environmental protection, water resources efficiency, cropland protection, disaster prevention and preparedness, healthy lifestyle, eliminating bad habits, and opposing foolish superstitions'. The intentions relating to improving farmers' scientific literacy are threefold: personal improvements (such as increased yields and incomes, improved lifestyles, and skills development); better employability of labour transfer to non-agricultural sectors or cities and towns; and raised scientific and cultural literacy for women in the rural areas and for farmers in certain strategic regions of lower development and ethnic autonomy.

The final group – leaders and public servants – is recognised in all three existing strategies, and potentially reflects increasing concerns regarding the scientific literacy of policymakers more broadly. Somewhat more cynically, it may also be a reflection of the government interest in the development of all three strategies – government departments relating to science and technology will of course want their colleagues in other departments to value and respect their work. One of the five key themes within the *Inspiring Australia* report is 'National Leadership', recognising the crucial role that leaders both within and external to the science communication can play in this regard. Within the UK a specific action relates to promoting 'successful knowledge exchange between the sciences, policy and business'. Within China the inclusion of policy leaders as an audience has already borne fruit, with more money being put into the popularization of S&T since the development of the *Scheme*. Industrial organisations and businesses are recognised as potentially very relevant partners however work within some countries has demonstrated that they are less visibly engaged in science communication than academia and the public and cultural sectors, focusing instead on activities which target young people directly (education, skills development and recruitment).

There is also a clear intention to improve audience diversity and widen the reach of science communication activities to less traditional audiences. In the UK the very name of the Expert Group – 'Science for All' – reflects this focus, and the other reports make similar mention of improving accessibility for under-represented groups within science, for example indigenous and rural communities.

Scope and focus

Each of the three published national strategies has been broken down into key areas of focus, with various action points recognised within each area. In the Chinese approach four 'action plans' have been identified, each relating to different aspects of improving the popularization of science and technology (PST):

- Science and education training
- Developing and sharing PST resources
- PST related infrastructures
- Capacity-building of science communication by mass media

Beneath each of these plans lies a subset of 'missions' and agreed targets.

By contrast, in Australia there are 15 'principles and recommendations' supporting five key themes:

- National leadership
- Telling the Australian science story
- Engaging all Australians
- Building Australia's capacity
- Mobilising Capability

In the United Kingdom there are 19 broad objectives which have been identified, with 60 specific actions or recommendations to help achieve them. The UK Action Plan is set out against three key challenges identified by the Science for All Group:

- A wider understanding of why, when and how the public engages with the sciences
- Supportive networks and mechanisms for increasing effective engagement

- A professional culture that values, recognises and supports public engagement with the sciences.

The respective plans share much in common with regards to specific recognised actions. The *sharing of resources* is a common theme, for example the development of an online 'collective memory' to share learning from evaluations of public engagement in the UK. Similarly, all three countries refer to *improving infrastructures* for science communication, although the focus in each case depends on the maturity and scale of the field in each country. In China and Australia the intention is to improve and/or create an appropriate national infrastructure, whereas in the UK the initial challenge is to better map the existing infrastructures that support public engagement. This is in part related to the wider existing infrastructures in each country – in Australia for example there are Local, State or Territory and Federal governments, each with different responsibilities relating to education, training, and science support. The development of a national infrastructure therefore needs to recognise government priorities at other levels.

Training is also an area that appears in all three published plans, although the audience and focus for the training does differ. In China this refers to education and science training for their four identified target audiences, whereas in Australia the focus is on 'communication training' (especially media training) for researchers and others associated with scientific research. In the UK there is recognition of the 'field' of science communication and the need to provide appropriate professional development of scientists and the increasing group of people working as professional science communicators. Further to this, the need for *reward and recognition* of researchers involved in science communication is highly visible within both the UK and the Australian strategies, including developing a 'Concordat for Public Engagement' by research funders in the UK to provide clear expectations as to their responsibilities in this area. The three countries also recognise the importance of *research and evaluation* in science communication, emphasising the importance of building their strategies on a clear evidence base.

The *mass media* are an explicit focus within both the Australian and Chinese strategies, and the UK addressed this through its 'Science and Media' report and action plan. Both Australia and the UK make mention of *online and social media* as opportunities for development, reflecting the high uptake of the Internet as a communication medium in those countries.

The main difference in approach between the three published strategies relates to their over-arching role: within both China and Australia there is a focus on *branding and public campaigning* as well as providing an over-arching strategy for national action. This focus potentially relates to an increased role relating to the marketing or publicity of science and technology to the various target audiences. In contrast, within the UK the strategy focuses on the development of a culture of public engagement and a recognition that there are many different and equally valid purposes and types of engagement. Indeed, one interesting piece of work being carried out in the UK by the Science for All Follow-up Group is the development of a simple tool to make explicit the different purposes and types of public engagement, so that individuals or organisations planning activities can place their objectives and plans in a wider context. There is also a recognition of the benefits to those involved in public engagement (as well as to public groups) within the UK strategy which are not made explicit elsewhere. Neither of these approaches is necessarily better than the other, but are likely to be due to cultural and ideological differences in the respective countries.

Conclusions

The four countries represented here – China, Australia, the United Kingdom and India – represent a wide variety of cultural and social perspectives. Their national strategies therefore contain key differences in order to reflect the priorities and needs of their populations. The test of the value of the different strategies will of course be in how well they succeed in achieving their respective stated aims. China is already five years into the implementation of its *Scheme,* however the UK is less than a year into its implementation phase. Australia has only recently received government approval to go ahead with the proposed strategy but will be entering its implementation phase within the next six months. India's strategy is still in formal development but is built on a long-standing commitment to policy in this area. With all four nations emphasising the importance of research and evidence-based development of their strategies this is certainly an interesting time to monitor and compare different national approaches.

The appendices are a rich source of information additional to the key recommendation details. In particular, Appendix 7 is a very useful snapshot of relevant Australian and international reports.

References

[1] The English version of the *Outline of the National Scheme for Scientific Literacy* is available at: http://www.kxsz.org.cn/english.html

[2] A PDF copy of the full *Inspiring Australia* report and strategy is available at: http://www.innovation.gov.au/General/Corp-MC/Documents/InspiringAustraliaReport.pdf

[3] The *Science for All Action Plan* and supporting documents may be downloaded from http://interactive.bis.gov.uk/scienceandsociety/site/all/2010/02/09/science-for-all-report-and-supporting-documents/

(Symposium: Engaging People in Climate Change Science)

A Critical Review of Science Communication in the World

Chair: Toss Gascoigne
Speakers:
1. Farmers drive their own climate change science communication–Jenni Metcalfe, Australia
2. Involving experts and citizens on Climate Change Debate–Giuseppe Pellegrini, Italy
3. Climate Change – a reality or myth? Communications that count–Jose George Pottakkal, India
4. Changing the climate through art and science communication–Janet Salisbury and Glenda Cloughey, Australia

Farmers Drive Their Own Climate Change Communication

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Abstract. This paper will present about a program involving 34 farmers across Australia who are being supported and trained to communicate with their peers about climate change science and actions for mitigating and adapting to climate change. It will report on the research behind developing this program, the activities of the program and the ongoing evaluation of the program.

The paper will also explore 'best practice' guidelines for engaging the public, media, governments and business in climate change, as developed through three 'Hot Air' symposia organized by the author in collaboration with the Australian Science Communicators.

Involving Experts and Citizens on Climate Change Debate–The European Project Accent

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Abstract. Climate change issues are clearly a growing concern for the public today. In recent years, people have received a great deal of information from media on the causes and consequences of climate changes, but–depending on countries and regions–the understanding of citizens and their engagement in these topics is still varied. Communication professionals are making effort to communicate the messages correctly. This presentation proposes to contribute to a global effort to develop news tools and actions on climate change from "informative" to the "active" procedures through the exchange and dissemination of practices that involve citizens in actions and dialogue.

In my talk I will start taking into consideration some recent data on European public opinion. Secondly, I will introduce the Accent project (http://www.i-do-climate.eu/), an initiative promoted by a group of 12 European science centers proposing "active procedures" of involvement on the issues of climate change. The science centers are using "active procedures": hand-on exhibitions, participative games, local citizens forums and many others, in order to engage effectively the public in such themes.

The central point in this presentation is the promotion of two-ways communication channels between the scientific community and the public. Specific attention will be given to the participation of scientists and the role of science centers in the development of communication tools and programs for the choice of scientific topics and for correct and clear information to the non-expert public.

Climate Change–A Reality or Myth: Communications that Count

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Abstract. Climate Change has been a topic of intense debate that polarized not only various stake holders but also the community of nations. It has become an economic and political issue although at the back of it all is the question whether globally climate is warming at a rate that can affect ecosystems and humans. This is a

question that can be answered by environmental and social scientists through observations, predictive models, etc. However, as recent chain of events in the media involving scientific communications suggest that we scientists have been poor communicators to the public. While quasi and pseudo scientists had a field day in the communicating baseless information, hard-core scientists especially natural and physical scientists had been left out of the debate partially because of their being cocooned in their own world, unable to meaningfully communicate the results of their observations and research.

In my brief involvement in participating in the recent public debate on the retreat of Himalayan Glaciers, I found the thirst of general public for information. This paper will try to analyse and introspect three specific instances of my attempt at communicating what I have learnt through research each in a different setting. The first was a live debate on Lok Sabha Television (People's Forum, February 28, 2010), the second being Earth Day Celebrations at Jawaharlal Nehru University (April 22, 2010) and third an Open Forum titled, 'Copenhagen and beyond' on World Environment Day (June 5, 2010). Each of these were a learning experience to me in communicating scientific observations and inferences to various shades of laymen. While all three where opportunities for public communication, what I would call scientific reticence inhibited communication of possible in the first event. The second, which was on home ground and the audience in general where university students and faculty from other fields of study, the take was much better. The third, in Kolkotta became for me an opportunity to communicate and inspire young and not so young people to study Himalayan glaciers.

Changing the Climate through Art and Science Communication

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Abstract. In its apocalyptic scale and emotionally charged urgency, climate change is like no other issue in science communication. Climate scientists hold knowledge about the fate of life on earth. And those who have studied the science in detail and written books must

sometimes have been overwhelmed. For example, in writing 'the future of biodiversity and civilisation hangs on our actions' (Flannery 2005, p.306), and 'there is almost no time left to act' (Lovelock 2006, p.8), these scientists are revealing the unbearable reality that underlies the unemotional graphs and statistics that are the tools of their trade.

Apart from the unacknowledged emotional burden the scientists bear for humanity, an honest emotional response to the significance of their assessments is rarely publicly discussed and hardly ever mentioned in communications from political and business circles. In relation to climate change, it is difficult to find examples of the axiom that communicators must 'talk with' rather than 'talk to' people about science, although this has been a well-accepted conclusion of the UK Government's report on *Science and Society* (HLSCST 2000), and the White Paper on science innovation policy for the 21st century, which stated:

'... science is too important to be left only to scientists. … When science raises profound ethical and social issues, the whole of society needs to take part in the debate.' (UK Department of Trade and Industry 2000, p.54)

The likelihood that artistic vehicles would help carry emotion and unblock the way towards emotionally mature, wise actions by policy makers has been explored in poetry, music and drama by the Canberra group A Chorus of Women in many presentations since 2007. These original presentations have drawn on the work of the Australian poet and environmentalist Judith Wright, Australian sculptor, Tom Bass the Greek playwright Aeschylus (480 BC).

This paper describes the philosophical, artistic and emotional underpinning of two of these presentations, and provides insights from the facilitated discussions between scientists and nonscientists that have followed the performances.

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New Developments in Assessing the Culture of Science

Chair: Marin W Bauer (LSE)
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Discussant: Gauhar Raza (NISTADS, New Delhi)

Construction of PUS Index in China–The China 2010 Civic Science literacy Survey

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Abstract. China's CAST and CRISP conduct surveys of science literacy since the early 1990s in China. The most recent in that series has been conducted in early 2010, and some preliminary results of this survey will be presented at the meeting. The challenge of the 2010 survey was to strengthen the sample of data collection so that indicators are robust enough to conduct regional comparisons within China.

Shifts in Science Culture? The Science Culture Index for Europe 1989 to 2005

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Abstract. The European Union has an survey instrument called Eurobarometer, which since the 1970s in irregular intervals conducts surveys of general attitudes of European to science and technology. A recent research effort achieve micro-integration of four of these surveys, which allows to conduct time-series analysis for EU12 and compare the changes and stabilities of these countries with regard to their science culture from 1989 to 2005 (2010). Some observations in that respect on the basis of an new index of 'science culture' will be presented to the meeting.

Literacy and Attitudes Measure in the Context of India's Youth Readership Survey 2009

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Abstract. NCAER was the author of the first all India Science Report in 2005. In that vain, the recent Youth Readership survey of 2009 included among other things a number of questions regarding the science culture of Indian Youth. The paper will present results from these questions, and compare the different regions of India on the relationship between science culture and readership activities of its youth.

Brazilian PUS Surveys 2010, 2005 and 1987: Change and Stability in Questions and Results

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Abstract. Brazil had undertaken its first national survey of public attitudes to science back in 1987, this effort has recently been revived with a national survey in 2005 and a very recent one in 2010. The paper will document the development of the thinking behind these surveys, how the items have change and present preliminary results of the most recent research to the meeting.

RETINA –Science Communication for Blind Students

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Abstract. Science has been reported as one of the easiest areas to promote inclusion of students with special needs. Nevertheless there is overwhelming evidence that blind or visually impaired students are frequently unsuccessful in Science related subjects. In 2010 the Outreach Science Unit from IPATIMUP started a long-term project focused on strategies to tackle this problem of Science communication, based on the use of hands-on and enquiry-based approaches.

We started a characterization of Science Education scenario for visually impaired students in Portuguese reference schools. In Portugal these Reference Schools integrate blind students in regular classes with visually able students and congregate human and material resources that can offer a better educational environment. From our preliminary observations we realize that the institutional model of the reference schools is unsuccessfully consolidated due to frequent organizational changes and lack of qualified human resources. Furthermore science curriculum is focused on the memorization of concepts and the students lack hands-on experience and enquiry-based learning. In order to evaluate the relevance of an enquiry-based model to effectively communicate science to blind students, we draw a collaborative study with the Science education research group from Reading University which aim to perform: A comparative study of science learning models for visually impaired students in Portuguese and UK schools, namely identifying: a) problems faced by the teachers, b) difficulties and limitations experienced by the students, c) examples of good practice. Based upon the data collected in this study we aim to develop a science communication program adapted for students with visual impairment. This study will bring new insights about the impact of the model (enquiry based vs non-enquiry based) in the effectiveness of Science communication for visually impaired students.

[Symposium: Communicating Climate Change in the Media–With Lessons From Climategate]

Climategate: What's in it for Science Communicators?

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Abstract. The presentation will report on the media and public coverage of the email controversy which involved climate scientists and was largely reported as a huge scientific scandal (it was dubbed Climategate by the media). On 19 November 2009, thousands of e-mails and other documents sent by researchers from the Climate Research Unit of the University of East Anglia appeared on a public website. The controversy came from the fact that some emails were interpreted as showing that researchers manipulated raw data, hide climate information or influenced the peer-review process in order to make the case for global warming appear stronger than it is. In July 2010, several independent reviews rejected allegations that climate scientists had colluded to manipulate scientific information, but the researchers involved and their institution were criticized for a culture of withholding information. The presentation will focus on the key lessons that can be drawn from this case for the public communication of science.

Digital Scholarship and the Changing Nature of Scientific Publication: The Implications of ‘Climategate’ for Science Communication

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Abstract. Digital media have extended the number of channels that scientists (and other academics) use to communicate and share information. Social media, such as blogs and social networking sites, provide opportunities for scientists to communicate with others about their work in more immediate and informal ways. As such, digital technologies have the potential to make all stages of the research process more visible in the public sphere. They also offer, on occasion, some opportunities for interaction and engagement with a wider range of audiences and stakeholders. In these respects digital technologies are introducing novel demands on researchers who choose to communicate in these ways, requiring skills and competencies on the part of scientists that are encapsulated by the concept of digital scholarship.

In this presentation we explore this developing context via a high-profile case study: the publication of emails from the Climatic Research Unit at the University of East Anglia (also known as ‘climategate’) in the run-up to the United Nations Copenhagen Summit (also known as COP-15). We will describe ‘climategate’ as a story of ‘private’ and ‘public’ communication, of freedom of scientific information and illegal hacking, all delivered via peer reviewed scientific papers, IPCC (and other) reports, websites, the blogosphere and professional news media.

In analyzing this episode we will briefly explore the role of professional media and social media in communicating information about the scientific consensus of anthropogenic climate change around COP-15. The findings of three reviews of ‘climategate’ will also be discussed in terms of their implications for science communication.

This episode may indirectly influence the ways that scientific knowledge is produced and verified, and what information and data are required to be archived for circulation in the public sphere when a peer reviewed paper is published. In the light of this, we argue that there is a need to develop norms to inform scientific *publication* in the widest sense of this term, to

include all forms of science communication that are available in the public sphere.

Science, Politics and the Media: The Climategate Disputes in France

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Abstract. Science is increasingly part of the public domain : scientific controversies, previously well protected from the public eye by the tacit rules which organise scientific communities since the XVIIth century, are more and more open to public inquisitiveness. There is a growing interdependence between science and politics. Political decisions must rely on scientific expertise while scientific and technological options and choices are evermore subject to political bargaining. The debate on climate change and global warming is a good example of this new direction in science history (history of science).

This paper will deal with the most recent media events concerning the "climategate" in France. We shall start with the analysis of Claude Allègre's *L'imposture climatique ou la fausse écologie*, which was published in February 2010 and triggered a number of responses of all kinds in the media. C. Allègre is a well known geophysicist and former minister of education and research in the last socialist government. His climatoskeptical views were already well known and widely discussed in the media but his book appeared as the last straw. The french community of some 400 scientists, as different from each other as the disciplines and the specialities they represent, but all involved in the French branch (GIEC) of the IPCC, published a petition against the « lies » of Claude Allègre, asking their minister, Valérie Pécresse, as their employer, to reassert the scientific status and the seriousness of their work and to prevent futher public diffusion of additional «lies» by Claude Allègre and his colleague, Vincent Courtillot. Allègre's crime according to the signatories of the petition is to have published under the cover of scientific background without peer control. This petition, in turn, was followed by numerous reactions in the media, generally condemning this appeal for a political intervention in what was considered by most journalists and popularisers as a scientific debate between experts. The petition also showed the difficulty for these scientists, highly specialised in various fields, to accept their position as lay people in relation to each other's narrow competence over this or that aspect. The general issue of climate change and global warming with its political overtones leaves them helpless within the public debate. Hence, this curious demand of the community to reaffirm the necessity of a clear cut separation between science and politics in order to recover an autonomy which would be provided by a politician! Such a move is contradictory as many debaters like Jean-Marc Lévy-Leblond or Benoît Rittaud have pointed out in the media. Bruno Latour's position presented in *Le Monde* (22nd of May, 2010) is also ambiguous. Recognizing the impossibility to disentangle expert's science from politics, Latour advocates for a new distinction between science and research. While the former is an area of undisputable facts prone to be popularized in a traditional way (reinforcing autonomy and control of the scientific communities on the public divulgation of «their» knowledge!), the latter integrates uncertainties within the field of scientific experimentation as well as within the field of political action. According to Latour, the «good» link between science and politics should involve a confrontation with uncertainties in both areas under the arbitration of the cautionary principle. How could the media deal with such a «proposal» which would radically change its role in the management of the relationship between science and society ? It is within such a media turmoil that the journalist Sylvestre Huet from the newspaper *Libération*, published his response to Claude Allègre (*L'imposteur, c'est lui*, Paris Stock, April 2010) pointing out all the scientific mistakes and inaccuracies in the book in order to discredit the political argument of the geophysicist. The journalist is attacking Claude Allègre as a scientist with scientific arguments while the latter is dismissing these arguments by relying on the global political relevance of his argument against the anthropic origin of global warming. Within this paper, we seek to identify the scientific and political stakes of this strange controversy.

The Translation of Scientific Concepts Related to Climate Change in the Spanish Press

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Abstract. Considering science as a “codified form of knowledge” leads to the need of translating scientific concepts, so that they can be understood by the public. But communicating science in the media is not an easy task, as it involves several processes of interaction between journalistic values and science, which can result in a lack of the expected rigour in the presentation of scientific concepts. Previous research shows that news stories on climate change often fail to explain science in a rigorous meaningful way. For example, in many cases, they do not include the necessary contextual information nor the causes and consequences of this phenomenon. But research has not explained so far if stories explain concepts by including definition of terms and the relationships among scientific facts, in view of their interaction with journalistic values. This presentation focuses on some preliminary results of a project conducted by a group of researchers of the University of Navarra, on the coverage of climate change in the Spanish media. More specifically, it studies how scientific concepts related to climate change are explained in the two leading Spanish daily newspapers (El País and El Mundo), during the Copenhagen summit, in December 2009.

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Translation of Scientific Concepts in the Media: A Study of Information on Climate Change in the Spanish Press

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Abstract. Considering science as a "codified form of knowledge" leads to the need of translating scientific concepts, so that they can be understood by the public. As academic research has shown, such processes of mediation are of paramount importance, since they can help to improve scientific literacy of citizens or they can impoverish it, by means of interpretations and images which are not rigorous. But communicating science in the media is not an easy task, as it involves several processes of interaction between journalistic values and science, which can result in a lack of the expected rigour in the presentation of scientific concepts.

There exist several differences between the processes involved in the production of information in the media and those of scientific work on climate change (CC). While nature processes take place in large periods of time, media work is characterized by a continuous search for the novelty, the immediate and the specific. The absence of "news values" has provoked that information on CC is not always as frequent as it should be, according to the social relevance of the topic. Furthermore, several traditional criteria used in journalistic work, such as the search for balance, have been a source of inadequate coverage of environmental issues.

Previous research shows that news stories on CC often fail to explain science in a rigorous meaningful way. For example, in many cases, they are too superficial and do not include the necessary contextual information (vg. the causes and consequences of the phenomena they portray). In addition, media tend to give priority to journalistic values and criteria over scientific rigour, which can result in stories that are not precise, from a scientific point of view. For example, media tend to translate hypothesis as certainties.

Research has not clarified so far if stories explain concepts by including definitions of terms and explaining the relationships among scientific facts, in view of their interaction with journalistic values. This paper focuses on some preliminary results of a project conducted by a group of researchers of the University of Navarra, on the coverage of CC in the Spanish media. More specifically, it studies how scientific concepts related to climate change are explained in the two leading Spanish daily newspapers (El País and El Mundo), during the Copenhagen summit, in December 2009.

Developing Scientific Literacy among Student Teachers: Using Media Reports of Scientific Research in the Classroom

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Abstract. Teachers, scientists and the media have important role in shaping young people's perceptions of science and science career choices. Today, it is widely accepted that science education should equip students with the knowledge and skills to become scientifically literate citizens (Elliott, 2006). Although the meaning of scientific literacy in the context of school science has been debated (Osborne et al., 2003), it is widely agreed that the ability to analyze and interpret text including simple media reports of scientific research is an essential aspect of public engagement with science and scientific literacy (Norris & Phillips, 2003). An understanding of science, therefore, requires the ability to read and understand the essential points of media reports that involve science. Because of its potential significance for personal and professional decision-making in a democratic society as well as participation in public policy debates over societal issues (e.g. debates on socio-scientific issues), the ability to engage critically with science in the media is seen a valued outcome of a contemporary science education and a manifestation of scientific literacy (Jarman & McClune, 2007). This study investigates how student teachers evaluate popular reports of scientific research and investigates their views on the use of such reports as teaching resources in the classroom. Participants were 32 primary student teachers enrolled in a science methods course in which they were introduced to some techniques (Elliott, 2006; Jarman & McClune, 2007; Norris & Phillips, 2003) to help them critically evaluate media reports of scientific research. At the end of the course, the participants were asked to find a popular report of science and write a report on its evaluation. The media reports were chosen from recent popular science magazines, nonscience magazines and newspapers. A document analysis of 27 reports was undertaken to evaluate the quality of the reports prepared by the student teachers. The reports prepared by student teachers were examined for a range of evidence such as the newsworthiness of the story, the portrayal of science and scientists, bias in reporting, the theoretical ideas involved, the accuracy of information and association between data and claims. The preliminary results indicate that student teachers valued the opportunity to analyze media reports of scientific research and gained greater confidence in the use of similar techniques in their teaching at schools. Some implications for teaching about scientific literacy and further research are discussed.

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Science Quiz on TV: An Interactive Approach to Promote Science to Elementary School Students

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Abstract. Since 2008, the Ministry of National Education of the Republic of Indonesia has decided to include science as one of the subject of the national level final examination for students, from elementary to senior high school level. Many programs, such as Science Olympiad and Science Festival, have been executed to encourage students to learn science.

This year, a new program has been carried out. DoctoRabbit was assigned by the Ministry of National Education to design and execute an interesting science quiz for elementary school students to be aired on TVRI (the government owned national television). The series of thirteen episodes of the program have been taped and just broadcasted since October 18, 2010.

The duration of the program was 55 minutes, consisted of four main segments, i.e. Science Games, Logical Test, Science Experiment, and Science Challenge. In every episode, there were 100 students from five teams involved as the participants and another 100 students as the audiences. Juries were elected from academicians, celebrities, and practitioners.

Students and teachers were excited with the program. The quiz has broaden the chance for more students to get involve in a science competition, while the chance to join in a Science Olympiad was limited to the best and intelligent students only. The competition was also in a fun environment. The Ministry was satisfactory with the program and planning to continue it next year.

Keywords: Science quiz, TV program, Science for the elementary school students

Introduction

Not many countries regulate a national exam for elementary school students (Year 6). Indonesia is one of very few countries that conduct it since 2008. There are three subjects to be examined: Indonesian Language, Math, and Science. This new regulation has brought pro-cons from educators and public. They who are in favor of the national exam told that the result would be a good data to map the quality of teaching and learning at schools all over Indonesia. But they who are against it told that it is not fair to the students since their final result will be judged only by the six hours exam, rather than the process of their six years of learning.

Whatever the pro-cons said, the reality to the students is they still have to face the national exam and put their effort to pass it. Every year, Year 6 students and their parents are busy with the preparation to make them ready to do the national exam. They take additional courses after school, although their schools have added longer hours for special preparation towards the exam. Many after school courses business arisen to take the opportunity. Consequently, teachers and parents tend to drill the students with all questions and answer exercises to memorize all subjects, without considering whether they understand it. It is a very stressful year for the students, teachers, and parents.

To help students to overcome their stress, educators and the Ministry of National Education should continuously offer several education programs that are fun and interactive for them to learn about the subjects, especially science. Otherwise, students may find science is a boring and difficult subject, and that situation will not supportive to the quality development of science knowledge and skills of the students.

The Important Findings

There were many researches have been conducted on science education for children. One of it was the Cognitive Acceleration through Science Education (CASE) project in UK (Bennet, 2003). The key research findings from that project were as follows:

- By the age of 14, pupils of average ability are unlikely to have developed the intellectual abilities to cope with abstract ideas in science.
- Much of the content of the science curriculum for 14-16-year-olds in the 1970s and 1980s was outside the intellectual grasp of substantial numbers of pupils.
- The CASE project has yielded evidence that a specific program of activities included in science lessons for pupils aged 11 and 12 will lead to improved performance in science,

mathematics and English examinations at age 16+.

- Explanations for the effects of CASE vary as to whether the materials enhance certain specific aspects of intellectual development or more general cognitive development.
- There has been debate in the literature over the claims made for CASE and the extent of its effects on pupils' performance.

Besides the above findings, we also know that there are three types of learning, so called “Bloom’s taxonomy of Learning Domains” (Bloom, 1956), which are consists of cognitive (knowledge), affective (attitude), and psychomotor (skills).

Science Quiz on TV

Based on the above research findings, especially the statement that the average children less than 14 years old have difficulties in understanding the abstract ideas of science and considering all children learning domains, I proposed the uses of an interactive science quiz on TV to promote science understanding to the elementary school students. Why does the science quiz on TV will help children to understand science? It is just simply because it is fun, entertaining, educating, and broadcasted nationwide. Children will eagerly watch the program without any objection.

Through my company, DoctoRabbit Science Inc., we proposed a concept for the Science Quiz on TV to the Ministry of National Education. It combined all learning domains and make the abstract ideas of science become more concrete or at least more understandable. It is fortunate that the Ministry accepted our proposal and appointed us to execute the program to be aired on TVRI (state owned TV Station). The program has been taped for 13 episodes and just broadcasted since October 18, 2010.

Duration of the quiz was 55 minutes and participated by 100 students from 5 schools (that means 20 students per school). There were 5 juries involved in every episodes, consists of a science educator, a science communicator, a psychologist or an educational expert, celebrity, and an officer from the Ministry of National Education. Content of the quiz was divided to 4 main segments played by different students from each team, such as follows:

Science games

It was a team racing games, played by 10 students per school. An example of the games was The Ampera Bridge (name of a bridge in Palembang – a town in Sumatera Island) where 8 of the team members made a bridge from 4 sticks to help the other 2 team members across ‘the river’ without falling down. They learned how to balance their body.

Logical test

In this segment, 3 team members would have to answer 4 questions included the reason of their answers after watching a video. To encourage students to answer the reason - regardless they answer is right or wrong, there were no zero scored unless they did not make any reason for their answers.

Science experiment

Other 3 team members were required to make a science experiment as instructed by the juries and make a presentation afterwards. Again, no zero scored for this segment. In fact, this segment score is the highest among all other segments since it needs both motor and presentation skills.

Science challenge

The last 4 team members would take part in this segment. They have to overcome the challenge given. For example, they have to follow a path in a mirror maze by looking through a mirror, without touching the side of the path that sound the alarm. If the alarm was sounded less than a certain number (which is decided by juries), then the successful team would get the highest score.

To make the quiz more attractive, each school was permitted to bring their own supporters or cheerleaders.

Conclusion

This interactive quiz was designed to cope with all aspects of learning domains and make the science ideas more concrete. We have not make any research for the result of this program, but from some interview to the students and teachers participated in this quiz, we found that they were very enthusiastic and enjoy the program.

The Ministry of National Education has also asked us to develop the quiz nationwide for next year. This could be a sign that this program is acceptable and probably right to be an alternative approach to promote science understanding to the elementary school students.

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Research Communication in a Young University: Cooperation between the University Library and the Information Office

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Abstract. This paper describes the role of the university and the information office at one of Sweden's young universities. How can the university library and the information office cooperate to support and communicate the research activities Examples of cooperation are given and new ideas presented.

Keywords: Research communication, Shift lectures, Library as a village, Research hub, Research gallery, Research slam sessions

Introduction

Malmo University is very young and has had a strong student focus since it started in 1998. In recent years the research focus at the university has become bigger. Parallel to this, the national governmental research funding has gone through a transition process from broad general funding towards more specific and profiled funding.

These changes have encouraged Malmö University to take a serious and close look at its research activities. Some of the principal parameters measuring research activities are the number of scientific, peer-reviewed articles and citations, and the university's ability and willingness to share and spread research results to the public.

Research Profile Malmo University

Research and postgraduate education is carried out throughout the whole University, often as partnerships between different fields. The strategy of research at Malmö University is collected in eight profiles, some of them multi-disciplinary:

- New Media
- Migration
- Urban Studies
- Sports in Transition
- Science of Education
- Oral Health
- Biological Interfaces
- Health and Social Conditions in Terms of a Life Cycle

Malmö University's Multi-Disciplinary Research Institutes

- Biofilms–Research Centre for Biointerfaces
- Research by Profession
- Malmö Institute for Studies of Migration, Diversity and Welfare
- Centre for Applied Worklife Science
- MEDEA Collaborative Media Initiative

Short Facts about Research at Malmö University (2009)

- Turnover: 28,5 million $/year
- 65 full professors
- 218 PHD-students
- 238 articles in peer-reviewed international journals

Film: http://vimeo.com/15022964

The role of the University Library and the Information Office

The key role for a University Library and for an Information Office is – of course – to support and serve the core activities of education and research. Any university library and any information office must reflect the university in which they operate.

How do we–the University Library and the Information Office–reflect Malmo University, a 12-year old hybrid university in Sweden's third largest city?

The Library as a Village

The university library is open to the public and quite a few citizens of Malmö are registered as users of the library and have acquired a library card.

Malmo University Library has for several years worked within the frame "The Library as a Village".

Every village has exhibition areas, advertising pillars, billboards, open lectures with comfortable seating facilities, squares, open areas, silent areas, noisy areas, a school, a church, a café, a gallery, a graffiti wall, a playground, studios, trees, concerts, parties, receptions, dinners–and so does Malmo University Library.

Together with the Information Office at the university we try to get as much as possible out of the library. The space, the exhibition areas, the advertising pillars, the billboards and the open lectures – called Shift Lectures – all in order to spread and to share research at the university.

An example: Every month we have a public audience of appr 100-200 citizens listening to research findings and debates on current issues at open and renowned lectures in the library. The lectures are broadcast on our main webpage in real time – a very effective way to reach out.

The Research Hub

Another interesting new feature at the university is The Research Hub. The Hub was created in a common project between the university library and the information office. It allows you to find descriptions of the university's research and researchers at a glance in one location. Originally made for the media, it is also very useful for anyone interested in finding out more about research at the university. The hub automatically gathers data from the Staff registry, from the Institutional Repository MUEP (Malmö University Electronic Publishing), from the description of research programmes and profiles, and from social networks like Twitter and Facebook if wanted.

Coming up http://forskarnav.mah.se

In the pipeline we have several ideas on how to develop our cooperation and the library as a village concept. Some of these ideas we are working with right now, some of them will be realised soon. The sky is the limit!

- Monitor and photos (portraits) at the entrance of the library, exposing Malmo University's research profiles. The descriptions of the profiles is made by the Information Department and these descriptions may alternate with an RSS-flow from our institutional repository currently showing the most recent theses
- Establishing a "Research Gallery" equipped with monitors, headsets, poster area and projectors to present current research and results and combine it with small presentations by the researchers themselves
- Research Slam sessions. Inspired by Poetry Slam, at Research Slam sessions the researchers are asked to make their own free interpretation of a topic, and the audience puts their vote to the best performance
- Cooperating with the Information Office and the regional TV channel, offering the library as an arena for TV spots and interviews about current research at the university
- Together with the Information Department establishing a mobile hotspot Xpo Malmo University. The hotspot makes it easy to move the research communication out of the university buildings

We are happy to receive your input and comments on our ideas about the library as a village and the cooperation between the University Library and the Information Office. Please don't hesitate to contact us.

Optimizing a Context-Based Science Communication Course for Science PhD Students

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Abstract. These days scientists are increasingly called upon to communicate about their work and its social and economic relevance to a variety of different target groups and stakeholders. To support this challenge, in 2007 a science communication course of four days within a month with a focus on engagement was developed at the Faculty of Science of Utrecht University, intended for PhD students with a special interest in public communication.

Over the past three years about 40 students have participated in 7 editions of the course, which comes in a Dutch- and an English language version. The course links theory of science communication to practice by facilitating participants to present their own research to real live audiences (i.e., context-based) with the intention of engaging the public and fostering dialogue.

This paper focuses on a critical retrospect of the course based on empirical data and various theoretical perspectives so as to further improve the course. The course aims to establish a change in mindset of the students: ‘from telling them what *you* know, to telling the *public* what they want to know.’ So the course is strongly focused on public engagement and based on the view of situated learning. Learning by doing is crucial in the field of communication, so the PhD students communicate about their own research in ‘real life’ situations, such as writing for publication on the web, or presenting for an actual school class. In addition peer feedback plays an import role. Participants learn a lot from and with each other through feedback sessions.

In collecting and analysing the data sets, which include observational notes, student evaluations and student performance, three different levels are distinguished: the intended level (course objectives), the operational level (actual teaching and learning process), and the attained level (learning experiences and outcomes of students). Differences in learning style, attitude towards science communication, domain specific background, and cultural background are explored in search of criteria for fine-tuning course in terms of format and for different student types.

Results show that aiming for two concrete products – an oral presentation and an article for a general audience – as the outcome of the course is a feasible goal. The quality level of the product is strongly related though to a person’s language proficiency. In addition the educational approach of ‘learning by doing’ combined with ‘social learning’ is a suitable approach for such a science communication course for PhD students, on the condition that the students’ apprehension for the unfamiliar approach in teaching the course is overcome in the first day of the course.

Introduction

Four years ago at Utrecht University a science communication course for science PhD students was developed with a focus on engagement. This was in response to the latest developments in the science communication field where a paradigm shift is being seen from the ‘classical’ or ‘cognitive deficit model’ to the ‘contextual model’ (Wynne, 1991). This means that the public more and more becomes an active partner in the communication process and is not perceived solely as a ‘receiver’, as is the case in the so called ‘deficit model’.

In addition (young) scientists feel an increased demand to communicate about their work and its social and economic relevance to a variety of different target groups and stakeholders. These days the EU only accepts research proposals in their 7th Framework Programme for Research and Technological Development, if a paragraph about the societal impact of the research is included. So research should have added value. The results should be useful - in some way or other - to society, and citizens should get to know about it. So PhD students have to train their communication skills and should be able to set out in simple terms why their research project is worth pursuing.

At the same time governments in Europe and elsewhere around the world see the added value of 'setting up a dialogue' with the public. The antagonism against genetically modified foods and 'socio-scientific' issues such as mad cow disease and the dioxin crisis ask for public involvement in decision-making processes. Science has become so complex and has such a global reach that many politicians feel decision-making in this realm cannot be left to the scientific community alone. Citizens should have their say about future developments in, for instance, nanotechnology.

That's why within science communication Dutch government wants scientists to enter more into dialogue (Commissie Esmeijer, 2003). Two-way communication is emphasized: scientists inform citizens and citizens inform scientists. Regional initiatives are sought after. An explicit mention is made of direct contact between scientists and high school students.

So the new science communication course needed to have an emphasis on 'engagement' and it should have added value to what was already available. First of all there were the books (for instance: A field guide for science writers, Blum et al, 2005) and websites with heuristics that are available on the issue. In addition short one-day courses on science communication with the public were available for PhD students, and Utrecht University offered several courses on academic communication skills (peer-to-peer communication). This meant the course had to fill the following niche: a more extensive course focused on communication with the general public and focused on 'real life' experience and the generation of concrete products.

As this course was developed by the Freudenthal Institute for science and mathematics education (FIsme) of Utrecht University, the following commonly held notions within the institute were used as a guideline for design criteria: engagement, concern-based, situated learning (hence also context-based), experiential learning, and the teacher is 'facilitator'. These notions are derived from constructivist views on learning. These views emphasise the active role of the learner in building understanding and making sense of information (Woolfolk, 2008: 411). (For a further elaboration of the notions see section 3).

Initially in the development process of the course these educational notions were taken as 'given' and now after four years, seven courses and 45 participants in total, it's time for a critical retrospect on the implementation of the notions in the course using goal-based criteria and an evaluation of the learning objectives of the course. Empirical data and theoretical perspectives will be used to answer the central research question in this study: How feasible and effective is the context – based science communication course for science PhD students?

Based on the outcome of the study suggestions will be formulated to optimize the course itself, and more general recommendations will be given for training and courses in science communication.

The Original Set-Up of the Course

In 2007 the science communication course was first developed for a total of 8 PhD students, ideally with different science backgrounds to stimulate the interactive learning process. During the course participants learned the basic principles that govern science communication to a general audience. They also had to implement this knowledge in two concrete communication products about their own research: a short interactive presentation and a popular scientific article. For a more elaborate overview of the educational design of the course see appendix 1.

The course participants worked together as a learning community. They learned a lot from and together with each other through feedback sessions. As a consequence the role of the teacher was that of 'facilitator' of the learning process and not of 'instructor'. On the basis of science communication theory, personal experience, reflection, and analysis of a range of different example cases, PhD students developed their own specific communication products.

The course sessions themselves took up three full and two half days during one month. During the same month, PhD students had to set aside a minimum of four more days to prepare and revise their presentation and article. As communicating with the public is something one mainly learns by actually doing it, the course strongly focused on 'real life experience'. So in addition to a trial-run presentation within the group, the final presentation was held at a public event for a general audience at the local Utrecht University Museum. The popular article was written with the aim to have it published.

For the first version of the course five learning objectives were formulated. At the end of the science communication course for science PhD students the course participant should be able to:

- switch his/her mindset from 'telling them what *you* know, to telling the *public* what they want to know'
- practice 'dialogue' rather than 'monologue' (i.e. engagement) with the publicdevelop and carry out a public presentation and write a popular scientific article based on basic communication principles
- assess the quality of communication products, both his / her own and those of others
- reflect in groups supported by giving and receiving feedback

For the first version of the course the PhD students were asked to participate by the teacher through personal invitation, using her personal network. The courses that followed were accompanied by a small advertisement campaign. Four months before the start of a course, the course was promoted by a mention in the newsletter of the science faculty and in the Utrecht University PhD newsletter. In addition a letter was sent to all scientific directors of the research groups in (veterinary) science and medicine, kindly requesting them to bring the course to the attention of the PhDs in their group (see appendix 2 for the accompanying course leaflet). The argument given in the letter and in the course leaflet to promote PhD students to participate in the course, was the increased demand on scientists these days to communicate about their work and its social and economic relevance to a variety of different target groups and stakeholders.

Elaboration of the theoretical framework

The new science communication course had to be developed with a focus on 'engagement in communication and setting up a dialogue'. This was in response to the latest developments in the science communication field where a paradigm shift is being seen from 'transmission' (the 'deficit') to 'transaction' (the 'contextual model') (Wynne, 1991). In this shift the public is increasingly being viewed as an active and equal partner in the communication process. During dialogue knowledge is being co-constructed by both parties in the communication process.

When 'engagement' is the central focus of the course and when one wants to gain credibility, one has to 'practice what you preach', also in the educational design of the course. So the learning individual should be seen as active and equal and as a partner in the co-construction of knowledge. Social constructivist views on learning embody these views.

Constructivism views learning as more than receiving and processing information transmitted by teachers or texts. Rather, learning is the active and personal construction of knowledge and acquiring skills (De Kock, Sleegers and Voeten, 2004). And the outcomes of this process of personal knowledge construction and acquiring skills are often tested against the experience, knowledge and competencies of others. So meanings are negotiated and co-constructed.

Therefore social constructivists see learning as increasing our abilities to participate with others in activities that are meaningful in the culture (Windschitl, 2002).

So from the perspective of (social) constructivist learning theory the notions, that were taken as a 'given' for the development of the course, will be further elaborated on.

1. **Engagement**: 'fostering dialogue with the public' is a central idea in the course. This means co-construction of knowledge is important. The learning theory of (social) constructivism fits well with such principles.
2. **Concern-based:** Learning is the active and personal construction of knowledge and acquiring skills. Each learner has unique needs and a unique background. So in this course there should be enough space for each participant to 'tailor' the course to his or her needs. To a certain degree the course can be and should be 'personalized'.
3. **Situated learning:** Situated learning is based on the idea that skills and knowledge are tied to the situation in which they are learned and difficult to apply in new settings (Woolfolk, 2008: 414). They are context-based. So science communication skills should be learned in 'real-life' situations and learned in a 'cultural setting' that is familiar to the science PhD students.
4. **Experiential learning:** Constructivism is associated with 'learning by doing' (Kolb, 1984), by participants being actively involved in the learning process and by reflecting on that process. This is what experiential learning is focusing on and this way of learning is integrated in the set-up of the course.
5. **Teacher is 'facilitator':** Social constructivism focuses on how individuals themselves make sense of information and generate knowledge in interaction with the social environment they are in. They should learn to discover principles, concepts and facts for themselves. Therefore the course teacher should facilitate that process, and steer away from the 'instructor' role. Participants should become 'owners' of their own learning process. This is the best way to ensure lifelong learning.

For a critical retrospect on the implementation of these five notions in the course and an evaluation of the learning objectives of the course, the following evaluative questions can be formulated:

1. Was the course set up in such a way that it did focus on 'engagement'? Can at the end of the course a participant switch his/her mindset from 'telling them what *you* know, to telling the *public* what they want to know'? Is at the end of the course a participant able to practice 'dialogue' rather than 'monologue' (i.e. engagement) with the public?
2. Did the course have 'space' to adapt the course to a participant's needs? Did the participants use this 'space'?
3. How is 'situated learning' integrated in the course? How is situated learning perceived by the participants? Is situated learning a good approach for a course like this one?
4. In what way does the course offer room for experiential learning? Did the participants work well through experiential learning? Did peer feedback work?
5. How is the teacher's role shaped? How did the participants perceive the teacher's role? Did the teacher stick to his / her 'facilitator' role?
6. To what extent were the learning objectives met?

As the course is based on notions derived from social constructivism, social interactions and cultural context are important. Therefore the following aspects of the population of PhD students will be clarified in the respondents' section of this article: cultural background, gender, and science background.

Respondents, data collection and analysis

Respondents

The respondents of this study are both course teachers - first author (6 courses) and Robert Kerst (1 course) - and the 45 PhD students who participated in the science communication courses. Liesbeth de Bakker is science communication lecturer at Utrecht University and developer of the science communication course. Robert Kerst is science communication officer of the science faculty of Utrecht University. Information about the PhD students regarding their cultural background, gender and science background was derived from the registration forms for the course. In total over a time span of four years seven science communication courses were held: four Dutch language versions and three English language versions. In total 45 PhD students participated: 28 to a Dutch language version and 17 to an English language version of the course. (Sixty percent female, fourty percent male).

For an overview of the cultural background of the participants see table 1. Table 2 gives an overview of the science background of the participants.

Table 1. Overview of cultural background of participants

Cultural background	**No. of participants**
Dutch	35
Asian	6
European	2
North American	1
African	1

Table 2. Overview of the science background of the participants

Science background	**No. of participants**
Pharmaceutical science	10
(Bio) medical science	10
Physics	9
Chemistry	5
Biology	4
Geology	3
Astronomy	2
Veterinary science	2

Data collection and analysis

By using a typology used in curriculum studies (Goodlad, 1979) the course was studied on three different curriculum levels: the intended (course objectives), the operational (actual teaching and learning process), and the attained curriculum (learning experiences and outcomes of students). For an overview of the data sources used for analysis of the science communication course on the three different curriculum levels see table 3.

	Curriculum levels		
Data sources	Intended	Operational	Attained
Course documents	√		
Observational notes		√	
Student evaluations			√
Student products			√

Table 3. Data sources and levels of analysis

The intended curriculum was uncovered by content analysis of relevant documents, such as the original documentation on the course (De Bakker, 2007). The operational curriculum was studied on the basis of observational notes on the actual teaching made by the course teachers. Finally, through student evaluations (see appendix 3 for the evaluation form) and assessment of student performance and products by the teacher, the attained curriculum could be determined.

Results

In an attempt to answer the main research question of this study - *How feasible and effective is the context – based science communication course for science PhD students?* – first of all the evaluative questions as formulated in section 3 will be answered, and where necessary and relevant for the three different curriculum levels: the intended, operational and attained curriculum.

Engagement

Intended curriculum*:* Was the course set up in such a way that it did focus on ‘engagement’?

From the original documentation of the course it appears that on the first course day the focus lies on ‘from telling them what *you* know, to telling the *public* what they want to know.’ The public should become the starting point in communication. And the public should become perceived as a serious partner in communication – a partner in dialogue. In the two assignments (the presentation and the written article) this perspective of ‘putting your audience central’ is emphasized, so interactivity in the presentations is strongly emphasized and promoted. An exercise such as writing a popular scientific article though has very little scope for interactivity or ‘dialogue’.

Operational & attained curriculum*:* Can a participant switch his/her mindset from ‘telling them what you know, to telling the public what they want to know’?

At the start of the course the attitude towards science communication of the PhD students was judged by the remarks they made on the first day of the course. It was clear that all of them perceived science communication from a ‘classical’ perspective. They were the ‘sender’ and the public the ‘receiver’. So they worked within the settings of the ‘deficit model’. Remarks like: *“I want to tell the public about science because they know so little about it and unknown makes unloved”*, were often heard when the students spoke about their motives for wanting to be involved in science communication. The contextual model where the scientists co-construct knowledge with the public was still far from their minds.

Gradually, as the science communication course progressed, it became clear from participants’ remarks and their written evaluation reports that most of them made a switch in thinking. In developing their products their first question often became: what would the audience like to know? As one Dutch female participant with a pharmaceutical science background put it*: “A strong point of the course is that it forces you to step out of your scientific role and to put yourself into the shoes of the public.”* As a consequence the participants’ communication products are (to a large extent) accessible and interesting for a lay audience. Still, a strong focus on communicating plain facts and ideas remains. The notion that it might be possible or desirable to generate knowledge in dialogue with a public is something that’s too far fetched for the participants.

Attained curriculum*:* Is at the end of the course a participant able to practice ‘dialogue’ rather than ‘monologue’ (i.e. engagement) with the public?

Even though the PhD students were explicitly invited to interact with their public during their presentation, it did not result into the desired attained level of the course. Most of the PhD students (about 50%) only managed to ask the public one or more questions during their presentation. About 20% of them really did something interactive with the public but these efforts did not yet lead to something that resembled a ‘mini-dialogue’. The rest of the course participants chose not to directly involve the public and only allow questions at the end. One Dutch male participant with a medical background remarked: *“I don’t like it, to ask the public questions mid-way the presentation. It disrupts my own story and it makes me nervous because you never know what* *answers they come up with."* About a quarter of the course participants felt the same way.

Concern-based

***Intended curriculum**:* Did the course have 'space' to adapt the course to a participant's needs?

Even though the general set up of the course was fixed, e.g. five sessions over the course of a month in which two communication products had to be made: a presentation and a popular scientific article, the separate course sessions left plenty of room for the participants to address specific issues that they were concerned about. On the first course day all participants were asked for their general personal learning aims and the teacher would keep these aims in mind for each individual during the course. In addition, if one participant would develop a special interest in a specific aspect of science communication, additional literature and guidance would be provided for the PhD student.

***Operational curriculum**:* Did the participants use the 'space' to adapt the course to their own needs?

Only very few students tailored parts of the course to their own needs. When asked for their general learning aims at the start of the course, most of them expressed very general aims. *"Learn to how to 'translate' a scientific message to one that can be understood by the public"* was the most frequently uttered learning aim (15 times). Some participants were more focused on improving their presentation skills (8 times), others their writing skills (4 times). So the course in general provided the information and the training of skills that were sought after. Hence the participants felt little need to use the space to adapt the course to their own needs.

Only two PhD students (one male and one female, both Dutch and with a medical background) explicitly asked to write a press release about their work as they had almost finished their PhDs and wanted to generate media attention for their work. This was facilitated by extra literature and more specific feedback.

There also was a female North American PhD student from veterinary science who felt she needed more assistance when it came to 'risk communication', so she received extra literature on the matter. This is of course an 'academic learning' approach but due to time constraints there was no possibility to deal with the matter in a more constructivist manner. Through self-study the PhD student used some of the information in the development of her presentation and written article.

From the student evaluations it emerged that most participants agree they've now got the 'basic' knowledge and skills for science communication, but still they feel there's a lot to learn. About 10% of participants feel they would have wanted more in-depth knowledge about different target groups and assignments for different target groups (so not only adults or high school students).

Situated learning

***Intended curriculum**:* How is 'situated learning' integrated in the course?

The starting point of this course is the authentic practice of the PhD students themselves. This means the course is based in the context of their own PhD research. Part of that context and practice is communication about their work, not only peer-to-peer, but also to other target groups such as the general public, or the funding agency. To foster the interactive learning process ideally eight participants from different science backgrounds are selected for the course.

In addition, the course's practical tasks are set in a 'real life' situation. The participants talk to a journalist about their research project, they present their research to a lay audience on a public event, and they write their popular scientific article with the aim to really publicize it, i.e. on a popular science website or the news magazine of Utrecht University.

Such ‘real life’ assignments take time. So 32 hours of contact time with the group were scheduled. This included ample time for feedback sessions to critically assess the products mid-way and to give constructive feedback. In addition each participant individually had to reserve a similar amount of time to make and revise the products at home.

***Operational curriculum**:* How is situated learning perceived by the participants?

It’s positively perceived. Many PhDs expressed they felt connected, part of a group with lots in common. This sentiment was most strongly experienced by the PhD students with a non-Dutch nationality. One male PhD student from African origin and with a background in chemistry remarked: *“It’s great to finally meet PhD students from a different science background and to find out we all struggle with the same problems, like publication deadlines and difficulties in explaining to family and friends what exactly it is you are doing.”*

In addition all PhD students were very happy to communicate about their own research and their own results if there was no risk in jeopardizing their official academic publications. Some students followed the course very early in their PhD track and they therefore did not have any results to report about. In that case they communicated about the social relevance of their research. One male Dutch PhD student with a geology background who did the course in the first half year of this PhD project remarked: *“It’s interesting to find that by thinking in the science communication course about the social relevance of my research project, I now also get a better grip on the research question of my PhD project”*.

***Attained curriculum**:* Is situated learning a good approach for a course like this one?

Based on the reactions on the student evaluation forms the answer is yes. Many of the assignments were as ‘life-like’ as possible and this scored high marks. The workshop in which the PhD students met up with a professional journalist who asked them all sorts of general questions about their research was a real eye-opener to the participants. Immediately they got a feel for their public and the ‘low’ or general level of interest the general public has in their PhD project. One Dutch female participant with a pharmaceutical science background remarked: *“I was really surprised that a journalist expects you to have some facts and figures ready about the disease or illness you’re studying just an aspect from.”*

In addition, the fact that the presentation and the writing exercise were set in a ‘real life’ situation was earmarked as the highlight of the course. Interestingly though, when it came to publication of the popular scientific articles which were written for the course, very few ended up in the public domain. Only six articles out of 45 were finally published: two on a popular science website for high school students (http://www.kennislink.nl/ search for articles by Vasco Verlaan and Paul Leclercq), two as a hand out with the presentation which was held within the framework of the course, one in the Utrecht University newspaper (www.dub.uu.nl) and one as a press release.

The reason that the other 39 articles weren’t publicized was twofold. Often the PhD students did not have concrete results yet, so the texts didn’t meet the requirements of the publisher. And occasionally the PhD students themselves decided they weren’t ready or willing to publicize their text just yet. One Dutch female participant with a physics background wrote in her evaluation: *“The time to write an article is simply too short to be happy with the final product. I need more time to think things over and process it all. I guess in another month a final rewritten version will come out.”*

Experiential learning

***Intended curriculum**:* In what way does the course offer room for experiential learning?

In experiential learning one makes meaning from direct experience. So the course was organised in such a way that the participants had to develop their own heuristics for science communication through dedicated exercises and experiences. The PhDs are put in ‘real life’ communication situations and afterwards they are stimulated to reflect on their experiences. This process is supported by the fact that the course participants are divided into two teams. Every course session these teams help each other in feedback sessions. They are taught to give constructive criticism on each other’s presentations and popular articles. And at the end all participants are asked to actively reflect on their own performance and communication products by answering a short questionnaire (see appendix 4).

The feedback and reflection moments that were built into the course were aimed at a group size of eight participants from different science backgrounds. However, often less than eight PhD students registered for a course, so the ideal mix could not be established. Only two courses had a good mix. Three courses had 50% of candidates with the same science background (biology and astronomy), so the mix was less than ideal. And in two courses there were more than 50% candidates with the same science background (medical and pharmaceutical science) but due to a lack of participants that was the best that could be achieved.

Operational curriculum*:* Did the course participants work well through experiential learning? Did peer feedback work?

Even though the course was set up in such a way that the participants had to develop their own heuristics for science communication through dedicated exercises and experiences, it soon appeared there was too little time and support for a full implementation of this approach. One male Dutch participant with a physics background said*: “It’s all very nice to have to talk everything through with the group but I’d rather have the teacher tell us what to do and how to do it best.”* So in the first course the participants made a strong plea for a reader with science communication literature and clear handouts with heuristics on the basis of which they could start developing their products. Only then they were willing to work with and learn from each other in peer feedback sessions.

Once started these peer feedback sessions worked well and in general it was thought that the process went in a constructive manner. Occasionally though some PhD students felt that their fellow students focused too much on the detail in the articles and in the presentations and not enough on the overall structure and approach to the communication products. In an attempt to steer the feedback process more into the right direction, special feedback sheets were made (see appendix 5). Another interesting observation was that 5 of the 6 participants with an Asian background had to get used to giving and receiving direct constructive criticism but after two course days they usually lost most of their reservations.

Teacher is ‘facilitator’

Intended curriculum*:* How is the teacher’s role shaped?

During the course the teacher takes on a facilitating rather than an instructing role. The participants themselves have to find answers to questions through discussion or feedback sessions. The teacher guides this process and tries to avoid giving direct answers. Within communication there are few black and white rules. Every course participant should find a way of communication, which suits him or her best and the teacher aims to facilitate this process, rather than to steer it into a particular direction.

Operational curriculum*:* How did the participants perceive the teacher’s role?

During the first course it became clear that mainly the two participants with a physics background had difficulty with the constructivist approach to learning that was applied in the course. They felt a need to have clear guidance from the teacher and asked for a ‘instructing’ role rather than a ‘facilitating’ role. The male participant with the physics background told the teacher: *"You're the professional, you tell me what to do. I don't think it's a good approach to figure it all out for ourselves in discussions and feedback sessions."* Later on his stance changed but only after he'd seen the teacher facilitate the exercise with a professional journalist interviewing some of the course participants. It was an exercise he'd appreciated a lot and had learned a lot from. He'd come to realize that there are other ways to learn than just straight from a teacher or a textbook.

Operational & attained level: Did the teacher stick to his / her 'facilitator' role?

The teachers had to grow in their roles as 'facilitators'. Both are used to the 'teacher' role and often they were too prone to give the 'right' answer or to come up with a ready made list of heuristics relevant for science communication. When it also appeared that the participants, certainly at the beginning of the course, preferred the 'teacher' approach, a decision was made to start the course in the 'teacher' modus but to change the approach when facilitating the production process of the two communication products. This intermediate model appeared to be working well both for the teachers as well as the course participants.

Learning objectives

Attained curriculum: To what extent were the learning objectives met?

The first two learning objectives have been discussed earlier under the heading 'engagement' as these two learning aims are directly connected to that notion. The other three learning objectives about developing the products on the basis of basic communication principles, assessment of quality of product, and the capability to reflect, will be discussed below.

When looking at the final products of the participants of the course the question 'whether the participant can develop a product on the basis of basic communication principles' can only be indirectly answered through the quality of their products. In all instances the final presentations were of sufficient quality and so were the written texts. However in 4 of 45 cases the PhD student had to carry out another rewrite of the final version before it was assessed as 'adequate'. One important aspect in judging whether a product was of 'adequate' quality was, whether or not the presentation or article was clearly of interest to a lay audience and understandable for them. And in some cases the text still looked like it was written for a fellow researcher. In other instances the structure still was unclear.

It's interesting to note that when the overall quality of texts is compared, a clear distinction can be drawn between texts which were above average quality and texts which were below average quality. Those above average quality were always written by people writing in their native tongue and those below average quality were written in English by people to whom English is their second language. So it seems language proficiency is related to the quality of a PhD students' product. This relationship also emerged when looking at the quality of the presentations.

When it comes to the assessment of products and reflection on the process and products, it became clear during the course that all course participants were able and willing to judge the quality of their other team members' products. In addition, from the students' self reflection sheets a clear sense of weak and strong points in their own presentation emerged. Many of them remarked that at the end of the course they felt they had made products that were better than before but that these products still could be improved on. *"Science communication is something learned by doing it a lot"*, one Dutch female PhD student with a medical background remarked. *"Practice makes perfect."*

Conclusion and Discussion

Based on the results as described in the previous section it is now possible to answer the main question of this study as mentioned in the introduction:

How feasible and effective is the context – based science communication course for science PhD students?

Feasible

At the end of the course all participants had produced both a presentation and a popular scientific article of adequate quality. So despite the language problems some PhD students had to overcome, all of them clearly had put their target audience central in their thinking and products.

Crucial factors when it comes to 'feasibility' are: enough time, constructive feedback and 'real' assignments. In terms of time, one should allow five course sessions over the course of a month, with a total of 32 hours. The PhD students should at least dedicate the same amount of time for 'home work', i.e. making the presentation and the article.

Peer feedback and feedback from the teacher are crucial in improving the products. By bouncing ideas off on other PhDs with a different science background it becomes possible to check whether your products are understandable and of interest.

Finally, working towards a presentation on a public event with a real lay audience is the ultimate stimulus to perform well and on time. There's a real feeling of urgency and it's seen as a real 'deadline'. It would be good to organise some sort of a similar stimulus for the writing exercise. This is lacking at the moment.

Effective

When it comes to reaching the learning objectives of the course, they are only partly met. The practical part of the course - making the products and assessing quality of the products and reflecting on the process and the products - can be termed effective.

However, in terms of 'engagement' the course is much less effective. Most of the participants now do mention in their reflection or evaluation that they are aware that they should put the public central in their thinking and products. This change in mindset though is only present in their products in the sense that they are (to a large extent) accessible and interesting for a lay audience. However, taking this train of thought further and opening oneself up to a dialogue with the public and getting into 'real engagement' with the public and the co-construction of knowledge, is still far off.

The answers to feasibility and effectiveness of the course are given with respect to a course that has undergone the following changes on the basis of the student evaluations in the past four years:

1. A reader of modest size was made to accompany the course
2. Teacher becomes a mix of 'instructor' and 'facilitator'
3. Instruction sheets were made to facilitate and focus the feedback process

It's interesting to note that all these three aspects veer away from a pure constructivist approach to learning. And they were made to accommodate the PhD students that participated in the course. If a teacher wants to 'practice what he/she preaches' he/she needs to put the students' needs central in the development of the course. In this case it appeared that the science PhD students were often only used to academic learning: receiving and processing information transmitted by teachers or texts. Situated and experiential learning is therefore totally new to them. That's why it was decided to start the course in a more 'academic' fashion and gradually introduce the situated and experiential learning approach. In practice this meant that the transfer of the 'theory', i.e. the heuristics for communication, was taught in an academic way and the production of the products was supported by situated and experiential learning. This also suited the teachers as they are also used to academic learning and were still growing in their roles as 'facilitators'.

As a consequence the course has become 'feasible' as it fits better with the students' and teachers' needs but at the same time it 'waters down' the situated learning approach. It is therefore no surprise that the ultimate goals of 'dialogue' and 'co-construction of knowledge' are far from being reached.

Is this a problem? In hindsight one has to say, no. It can be concluded that the course as it is held now fits the PhD students' needs. Improving their communication skills with presentation and writing assignments that are examples of more 'classical forms' of communication, focused on transmission rather than on transaction, are just what the participants need at the moment. They are not 'up' to transaction just yet, but the first step in terms of awareness raising on the issue of engagement has been made.

So the course should not stray from its focus on 'engagement'. In both public communication and education it's a goal worth striving towards. As this notion of 'engagement' becomes more well known in the academic world, and if learning in academia slowly but surely - partly - undergoes a change towards situated learning, then maybe in 10 or 20 years' time the PhD students then may well be up to whole-hearted 'engagement' with the public.

Implications for Educational Practice

1 Based on this critical retrospective the following suggestions can be made for the context-based science communication course for science PhD students (these suggestions aim to both keep the PhD students' needs in mind while at the same time work towards reinforcement of the social constructivist character of the course):

1. Just like the presentation exercise the writing exercise should be made for an actual target audience who would also give (direct) feedback. Bring the target audience into the course sessions. Or, as an alternative, a professional journalist could participate and give feedback on the articles. This would give the writing exercise just as much urgency as the presentation exercise. At the moment this is lacking.
2. Currently the social constructivist foundation on which the course is built is not emphasised, let alone mentioned. This should change. As the group thinks about a changing society and the consequences for communication (from transmission to transaction), one should immediately link through to the consequences for education.
3. More participants from different science backgrounds are needed. At the moment less than 1% of all science PhD students of the faculty of Science at Utrecht University participates per year. Apparently the course leaflet is not powerful enough in emphasizing the value of adequate science communication skills. Maybe focusing on the value of better public communication skills for grant proposals should be emphasized as well. Another suggestion might be to try and invite the supervisors of the PhD students to follow the course themselves. This way they can personally experience the relevance and importance of the course for their PhD students and facilitate and enthuse their PhD students for the science communication course. Or, last but not least, ex participants of the course who have made a mind switch and have become enthusiastic, could be asked to bring the course to the attention of their peers.

More in general the following recommendations can be made for science communication training and courses:

1. A focus on 'engagement' as a starting point for a science communication course is a good one but one has to realise that most people are not ready yet for 'dialogue' and the 'co-construction of knowledge'. Therefore adapt the course to your participants' needs and see

'engagement' as the ultimate goal the group is working towards.

2. As communication is learned mainly by doing it, situated and experiential learning is the ideal basis for a communication course. Allow enough time for feedback sessions, reflection and the production and revision of the actual concrete communication products.
3. Ideally the teacher should be a 'facilitator' but the teacher can only take up this role once the students have embraced the idea of situated and experiential learning. Therefore, make sure that in the first day of the course the educational set-up of the course is explained and that the teacher gains credibility through establishing him- or herself as a professional in the science communication field.
4. Try to work from 'real-life' experiences as much as possible. Establish at certain times in the course contact between the course participants and their target audience of preference.
5. (Peer) feedback and reflection are crucial in the learning process, but such things don't come naturally to many of the course participants, so make a point of actively asking them to engage and give them enough support during this process.

Acknowledgement: The first author would like to thank Robert Kerst for his enthusiasm and support in carrying out and optimizing the science communication course for science PhD students.

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Appendix 1

Educational design

for the context-based science communication course
for science PhD students
(brief English language summary of the original course documentation in Dutch)

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May 2007

The science communication course is developed for a total of 8 PhD students, ideally with different science backgrounds to stimulate the interactive learning process. During the course participants learn the basic principles that govern science communication to a general audience. They have to implement this knowledge in two concrete communication products about their own research: a short interactive 10-minute presentation and a popular scientific article of about 800 words.

The course sessions themselves take up three full and two half days during one month. During the same month, PhD students have to set aside a minimum of four more days to prepare and revise their presentation and article.

To foster a good learning process several times the full cycle of experiential learning has to be completed. This learning cycle exists of the following phases: concrete experience (CE) >> observation and reflection (OR) >> formation of abstract knowledge (FAK) >> active application of knowledge (AAK). Through AAK one immediately ends up again at the beginning of the learning cycle: phase CE. Through repeated cycles a course participant gradually grows towards the fulfillment of the learning objectives and the development of relevant knowledge and competencies.

For each day of the course the learning activities will be described and the learning phases (CE / OR / FAK / AAK) will be included.

<u>Day 1: “Focus on target audience”</u>
Morning session: introduction of the course (CE); getting to know each other and each other’s research (CE / OR / FAK / AAK); identification of aspects in th research that are difficult to explain to each other (OR); search for possible solutions (FAK); communication theory (FAK).

Afternoon session: all participants formulate their ‘research in a nutshell’ (AAK / CE); peer feedback instruction (FAK); peer feedback session on ‘research in a nutshell’ texts (OR / FAK); formulation of a heuristic for proper science communication with a lay audience (FAK); professional journalist interviews participants about their work (CE / OR / FAK / AAK)

Homework: rewrite your ‘research in a nutshell’ text and develop plans for your written article and your presentation for a general audience.

<u>Day 2: “Focus on product”</u>
Morning session: Short theoretical introduction on presentation skills (FAK); analysis of a presentation of a scientist on DVD (CE / OR / FAK); peer feedback on initial presentation plans (AAK / CE / OR / FAK)

Afternoon session: Short theoretical introduction on writing skills (FAK); analysis of two popular science articles (CE / OR / FAK); peer feedback on rewritten ‘research in a nutshell’ texts and initial plans for article (AAK / CE / OR / FAK)

Homework: Group 1 writes their first version of their article. Group 2 prepares their first version of their presentation.

Day 3: Product analysis I
Morning session: Peer feedback session on trial-run presentations (CE / OR / FAK / AAK); peer feedback session on first versions of articles (CE / OR / FAK / AAK)

Afternoon session: More theory on writing and presentation skills (FAK); metaphor exercise aimed at finding new ways of explaining difficult concepts in research (CE / AK / FAK / AAK)

Homework: Group 2 writes their first version of their article. Group 1 prepares their first version of their presentation.

Day 4: Product analysis II
Morning session: Peer feedback session on trial-run presentations (CE / OR / FAK / AAK); peer feedback session on first versions of articles (CE / OR / FAK / AAK)

Homework: Everybody works on their final versions of their presentation and their written article.

Between ‘Day 4’ and ‘Day 5’ all presentations will be held in front of a ‘real’ general audience (CE / OR)

Day 5: Completion
Morning session: Feedback from teacher on articles (OR / FAK); reflection on presentation and article (OR / FAK); evaluation of course (OR / FAK)

Appendix 3
Course evaluation 'Science communication for PhD students'

Course dates	**8 January – 26 February 2010**
Presentation	**Anna van Rijn College / University Museum (3 / 5 Feb)**

1. General course remarks

1.1	Are the general aims / objectives of the course clear?	*Unclear* 1 2 3 4 5 *Clear*
1.2	Does the course offer you enough space to tailor its contents according to your own needs?	*Insufficient* 1 2 3 4 5 *Sufficient*
1.3	Do you think the practical approach (working towards two concrete products) is useful?	*Not useful* 1 2 3 4 5 *Useful*
1.4	Do you think the peer review / feedback sessions are useful?	*Not useful* 1 2 3 4 5 Useful
1.5	Does the course have the right level of difficulty?	*Too low* 1 2 3 4 5 *Too high*
1.6	What do you think about the balance: invested time / quality of your product?	*Bad* 1 2 3 4 5 *Good*
1.7	What's your overall level of appreciation for the course?	*Low* 1 2 3 4 5 *High*

Strong and weak points *General course remarks*

2. Content

2.1	How useful did you find the course material which was offered?	Unuseful 1 2 3 4 5 Useful
2.2	How challenging did you find the assignments?	Boring 1 2 3 4 5 Challenging
2.3	How clear did you find the assignments and course material?	Unclear 1 2 3 4 5 Clear
2.4	How satisfied are you with the feedback on the ‘elevator talks’?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.5	How satisfied are you with the creative exercises (mind map / dictionary exercise)?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.6	How satisfied are you with the ‘metaphores’ exercise?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.7	How satisfied are you with the general communication theory?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.8	How satisfied are you with the presentation theory and the film of Hans Rosling (‘Debunking myths’)?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.9	How satisfied are you with the writing theory and accompanying exercises?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.10	How satisfied are you with the interview workshop?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.11	How satisfied are you with the feedback on the try-out presentations?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.12	How satisfied are you with the feedback session on the articles?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
2.13	How important is presenting in front of a real ‘lay’ audience for you?	*Unimportant* 1 2 3 4 5 *Important*

Strong and weak points *Content*

3. Lecturer

3.1	How satisfied are you with the supervision / support of Liesbeth de Bakker?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
3.2	How clear was the teaching of Liesbeth de Bakker?	*Unclear* 1 2 3 4 5 *Clear*
3.3	How inspiring did you find Liesbeth de Bakker as a lecturer?	*Uninspiring* 1 2 3 4 5 *Inspiring*
3.4	How satisfied are you with the contactability of Liesbeth de Bakker?	*Dissatisfied* 1 2 3 4 5 *Satisfied*
3.5	How satisfied are you with the guest lecturer of the interview workshop (Marnie Chesterton)?	*Dissatisfied* 1 2 3 4 5 *Satisfied*

Strong and weak points *Lecturer*

4. Learning aims / Competences

4.1	How adequate is your knowledge / skill now in terms of presentations for a lay audience?	*Inadequate* 1 2 3 4 5 *Adequate*
4.2	How adequate is your knowledge / skill now in terms of writing a popular scientific article?	*Inadequate* 1 2 3 4 5 *Adequate*
4.3	How adequate is your knowledge in terms of different target audiences?	*Inadequate* 1 2 3 4 5 *Adequate*
4.4	How adequate is your knowledge / skill now in terms of giving feedback?	*Inadequate* 1 2 3 4 5 *Adequate*
4.5	How adequately can you now convey your inspiration for your work?	*Inadequate* 1 2 3 4 5 *Adequate*
4.6	Overall, how much have you learnt?	*Not much* 1 2 3 4 5 *A lot*

Strong and weak points *Learning aims / Competences*

Any other comments you'd like to make …. ? (for more space p.t.o.)

Appendix 4

Personal evaluation presentations (Anna van Rijn / University Museum)

Can you please give me (the lecturer) insight into a couple of issues:

- Please write down a strong and a weak point of your own presentation (your personal opinion)

- What were the main comments from your public (strong / weak) ?

- Did you learn anything new during the experience of presenting itself?

- Did you find out what the public wanted to hear from you (need-to-know)? Please write it down in 5 sentences.

Appendix 5

Appendix 1: Concise feedback form (for reviewing the first version of the article)

Author / Title: ………………………………………………………….Feedback from:

1. Read through the article in one go. Mark where the text reads smoothly and where reading is hampered. Text might be uninteresting, confusing or too difficult.

2. Please write down for the following categories what the strong and weak points of the article are. Add suggestions for improvement:

a. Does the lead contain the right information (e.g. a summary and an incentive)?

b. Is the focus (angle to the story) maintained throughout the whole article?

c. Does each paragraph contain one main thought?

d. Is there coherence within the text and each paragraph?

e. Does the article have a clear (summarizing) ending?

f. Is the most important information put first and the less important information placed more towards the end?

g. Does the text read smoothly (a pleasant style and tone)?

Socio-cultural Cognition as a Moderator of Science Communication in India

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Abstract. Science communicators in India assume that people are isolated, N-number of individual units of asymmetrical scientific cognition and 'knowledge deficiency' which can be addressed by a top-down, structured, rationalized flow of information and education. They fail to understand that humans are an organic part of a socio-cultural 'whole' with complex cognitive and emotional inter-connectedness. Based upon our live experience of science communication in India and the review of extant literature, we have tried to disentangle the values associated with the scientific community's approach to science communication in India and those of the general public who are supposed to be enlightened.

Keywords: Cultural cognition of people, Deficit of knowledge, Pluralistic approach, Science communication, Top-down process

What drives Climate Change 'Drifters'

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Abstract. There has been a significant drift globally in public belief in anthropogenic climate change–with varying degrees of drift in different countries. Much effort has gone into trying to diminish this drift by better clarifying and arguing the science behind climate change. But evidence indicates that the drifters are not primarily motivated nor dissuaded by the science, and science-based discussions need to be radically reframed to have any impact upon them.

Keywords: Climate change, Sceptics, Public attitudes

Introduction

Several years from now, when science communicators have finished analyzing and dissecting the communications efforts of global climate change, it will most likely be seen as an excellent case study for the development of science communications thinking—towards being more audience-centric, and understanding the need for multiple and complex solutions to multiple and complex problems.

At least if we learn lessons from climate change communications it will be.

Much climate change communication could be described as 'almost good'–but that is like a bridge being 'almost long enough' to span a chasm. An irony is that, taken collectively, the many different communication strategies and theories being applied would probably span the chasm quite easily, and would constitute a multiple and complex approach. But many efforts to date have been characterized by being more competitive than co-operative.

This is in part due to the reverse panopticon prison effect.

To explain: the panopticon was a model prison, designed by the English philosopher and social theorist, Jeremy Bentham, in 1785. The basic concept was of a huge circular building of many jail cells, all with an open barred side on the inside, all pointing towards a central observation post. A prisoner could never tell when the jailer, sitting out of sight inside the observation post, might be watching them. The concept of the prison as a new mode of obtaining power of mind over mind, was later popularised by the French philosopher Michel Foucault.[1]

In the reverse panopticon, the perspective is turned around, so instead of having one central observer, we consider the perspective of the dozens, if not hundreds, of different perspectives from the cells, all looking towards a central point. And trapped inside the cells the prisoners have no idea of what the other perspectives might be, and can only see the world from their singular perspective. The irony, again, is that taken together they would have a more complete world view than would be possible for any one person.

This is the problem that has assailed much climate change communications, and indeed many attempts to address multiple and complex problems. It is repeated over and over whenever interest groups are captive to the limited perspective of their cells, and argue stridently that their singular perspective of the solution to any problem is the one that needs to be most heeded, and how the others' are clearly faulted.

The effect is also evidenced in the adage, 'We don't see things as they are, we see things as we are.'[2]

So let's begin by considering that the problem of climate change is multiple and complex, and therefore in need of multiple and complex solutions to effectively address it, and that this requires an attempt to pool as many different strategies and perspectives together as possible.

From that perspective, this paper looks at climate change drifters, those who once believed in or supported the idea of global climate change, but no longer do. The research is based on seeking to understand their perspectives, rather than seeking to convert them, for we should begin any attempt to better understand the drifters by talking to them rather than scorning them. By looking at a wide spread of research into into the psychological causes of climate change drift, including public attitude research and focus group findings from discussions with climate change drifters, some lessons can be learned as to the benefit of incorporating different perspectives into strategic communications towards this section of the population.

To begin with, five key lessons I have learned from ten years of dealing with public reactions to contentious technologies including stem cells, GM foods and nanotechnology, that are applicable to understanding the drifters:

1. When information is complex, people make decisions based on their values and beliefs.
2. People seek affirmation of their attitudes (or beliefs) – no matter how fringe – and will reject any information that is counter to their attitudes (or beliefs).
3. Attitudes that were not formed by logic are not influenced by logical arguments
4. Public concerns about biotechnologies and nanotechnologies (and climate change as well) are almost never about the science – and scientific information therefore does little to influence those concerns.
5. People most trust those whose values mirror their own.

The first thing that it is vital to understand is that for many of the climate change drifters the issue is not the veracity of the science, and arguments about the science do little to change their minds.

Deficit 2.0 Model

That the public or sections of the public should have a science-centric view of the world is what I term the Deficit 2.0 Model, based on the dogma that: If only you thought more scientifically (like me) you would get it!

Instead, I would argue that, if scientists and science communicators only thought more like climate change drifters, they would get it. 'It' being a better understanding of their perspectives, values and likely influences. And from having talked to many drifters, instead of asking: 'Why have so many members of the public changed their belief in climate change?', the more relevant questions seems to be: 'Given the circumstances, how could they not?'

So what exactly are the drifters telling us?

From the evidence of letters to the editor and talk back radio and so on, they key issue amongst climate change drifters appears to be a loss of confidence in the reality of, and the science behind, climate change. This is being articulated in these mediums as being due to several factors, including:

- Globally and locally governments can't agree on what do to,
- Scientists appear to disagree on findings and distort the truth,
- Emission Trading Schemes and Carbon Taxes are either very complex or in disarray,
- There are too many messages of over-whelming doom and gloom, and
- There is a feeling that nothing they do (or have done) really made any difference.

To test these statements the Department of Innovation conducted a focus group and an online poll with climate change drifters. The focus group was held in Melbourne on 17 May 2010. Participants were recruited based on their agreeing with the statement that they now believed less that climate change is happening than they had in the past. The group comprised:

- A 35-year-old single male, recruitment consultant for construction and engineering.
- A 44-year-old male, machine operator, married with a daughter.
- A 38-year-old married female, executive assistant.
- A 41-year-old married female accounts worker, with four teenage boys.
- A 45-year-old male, married with one daughter, working in aged care management
- A 29-year-old married female, employed with two daughters.
- A 46-year-old married investigator with two children.

The purpose of the focus group was to better understand the reasons for their decreased belief that climate change was happening, and the moderator began by presenting them with two statements and asking them which one they most aligned with.

STATEMENT 1: *I feel a sense of disarray about climate change due to the complexity, lack of trust, doom and gloom and no indication of what to do about it.*

STATEMENT 2: *Climate change is not as bad as I've been told and I don't need to do anything or incur any costs.*

All participants stated that they most agreed with Statement 1, and while not all participants agreed with all parts of the statement, they all wholeheartedly agreed that they felt a sense of disarray about climate change. In addressing reasons for moving from believing in climate change, key motivations given were:

Confusion

- There was a sense of cynicism within the groups that the climate change debate was largely controlled by the media and was now more about money than saving the world.
- Over the past few years the participants had heard various messages that climate change was getting worse, or that it was under control and also that it was not as bad a problem as it had originally been made out to be.
- Two to three years ago there was a much clearer message that climate change was a real problem; but this was not the case any more.

Lack of trust in government and science

- Coupled with not knowing what to believe, there was an overarching lack of trust in anyone who had an opinion on climate change.
- Government, both locally and globally, had a large part to play in participants' change of feelings towards climate change.
- Scientists, too, were accused of adding to the general confusion surrounding climate change; they presented conflicting messages about the reality and impact of climate change.

Clear and consistent messaging

- Their current state of confusion meant the participants were unlikely to trust anyone or know what to believe any more. Regardless of who were to deliver a message, be that a politician, a scientist or even a celebrity, the participants felt any message delivered would have a hidden agenda.
- Until a clear and consistent message about climate change was promoted and acted upon by those delivering the message (essentially led by government), there was little hope of the participants doing anything further than what they were currently doing.

Online poll data

These findings were then fed into the design of an online poll, held in June 2010, seeking to obtain data from a wider range of climate change drifters. One thousand people were surveyed, based on their being filtered for inclusion by agreeing to one of the following statements:

- I am confused as to what to believe about global climate change because of the conflicting messages,
- Global Climate change is happening, but is not as severe as we have been told.
- Global climate change is happening, but is not caused by humans,
- Global climate change is not happening.

The sample group surveyed could then be broken down into:

- The confused (52 per cent)
- The moderate sceptics (45 per cent)
- The most sceptical (2 per cent).

Among this group 55 per cent said their levels of concern about climate change had increased over the past years, 43 per cent said they had stayed the same and 3 per cent said it had decreased.

When just the moderate sceptics were filtered for this question (484 people), 45 per cent said their levels of concern had increased, 50 per cent said they had stayed the same and 4 per cent said they had decreased. Amongst the most sceptical (25 people) all stated that their concern had increased.

Trust in the claims of scientists amongst the overall sample and amongst the moderate sceptics was fairly consistent, with 20 per cent and 19 per cent having increased trust, 60 per cent and 58 per cent same trust and 20 per cent and 23 per cent diminished trust. But amongst the most sceptical there was no increase in trust: 24 per cent stayed the same and 76 per cent had decreased trust.

The divide in attitudes towards questions of belief in climate change amongst the general survey population, the moderate sceptics and the most sceptical is shown in figure 1.

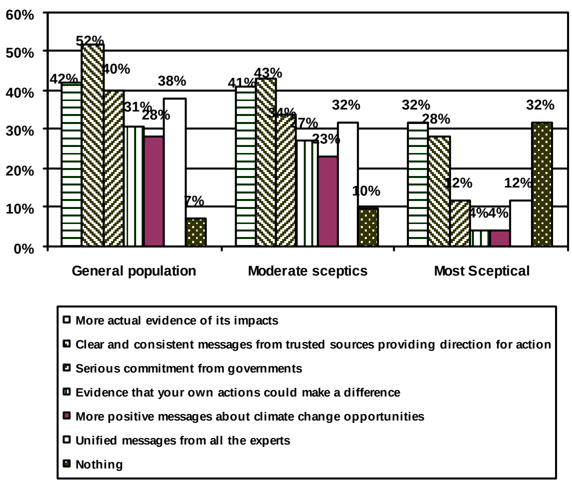

Figure 1: Which statement best describes your feelings about climate change?

Then, addressing the question: ‘What types of information or activities might make you more convinced that climate change was a serious issue with significant impacts?’ – the moderate sceptics were again not too far different from the general survey group, but there were significant differences with the most sceptical, as shown in figure 2.

It is fair to assume that the most sceptical are unwilling to change their positions, but the confused and moderate sceptics clearly stated what types of arguments or evidence was most needed to convince them of the reality of climate change. These are shown to be multiple and complex, and unlikely to be impacted by a single message.

An issues not addressed in this small study was the impact on attitudes of anti-climate change stories. But while there has been considerable debate on information versus misinformation in the climate change debate, it is perhaps more important to focus, not on the fact that there are many anti-science misinformation campaigns being conducted, but on the reasons they are resonating with a substantial proportion of the public.

The Psychology of climate change denial

This leads us to try and better understand the psychology of opinion on climate change. Attempting to correlate the findings of several studies, and achieve a wider perspective, there are some key findings that stand out.

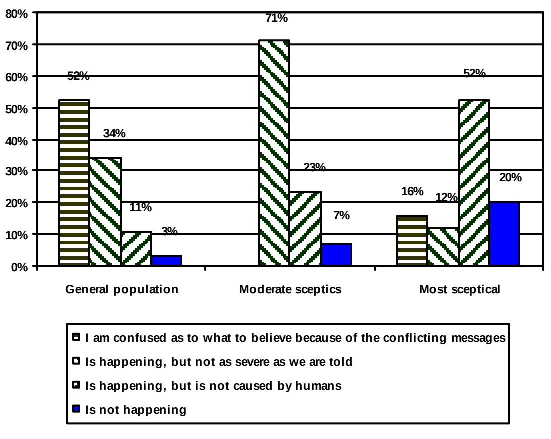

Figure 2: What types of information or activities might make you more convinced that climate change was a serious issue with significant impacts?

There has been a matched growth in both scientific evidence and scepticism and denial

According to Kari Marie Norgaard, a Whitman College sociologist, this seeming inconsistency can be explained as:

“Our response to disturbing information is very complex. We negotiate it. We don’t just take it in and respond in a rational way. Climate change is disturbing. It’s something we don’t want to think about. So what we do in our everyday lives is create a world where it’s not there, and keep it distant.”[3]

Which indicates that more scientific evidence is probably not the answer.

Sustained doom and gloom messages conflict with many people’s belief systems

Linda Connor, an anthropologist at the University of Sydney, has commented on this, stating that:

“As Ernest Becker argued over 30 years ago, the denial of death and the perpetuation of self and social group is the defining element of cultural world views…”[4]

She has said that negative messages about the future, such as those expressed in discourses of climate crisis, are a challenge to our cultural projection of immortality, and such negative messages, connected with death and decline, cause conscious and unconscious defence mechanisms that prompt us towards the life affirming messages of consumer capitalism.

Similarly, a study by Stoll-Kleemann, O'Riordan, Jaeger, found that in order to overcome cognitive dissonance, people’s minds create a number of socio-psychological denial mechanisms. These heighten the costs of shifting away from comfortable lifestyles, set blame on the inaction of others, including governments, and emphasise doubts regarding the immediacy of personal action “when the effects of climate change seemed uncertain and far away”.[5]

This is quite similar to the reactions of the focus group held in Melbourne which suggest that negative messages may turn more people into drifters, and more positive perspectives may be needed.

Psychological barriers to accepting climate change

According to the American Psychological Association, key psychological barriers to accepting climate change include:

- ***Uncertainty*** – over climate change reduces the frequency of 'green' behaviour.
- Mistrust – most people don't believe the risk messages of scientists or government officials.
- ***Social comparison*** - People routinely compare their actions with those of others and derive subjective and descriptive norms from their observations about what is the "proper" course of action. e.g. Al Gore's large residence has been used as a justification for inaction.
- ***Undervaluing risks*** – A study of more than 3,000 people in 18 countries showed that many people believe environmental conditions will worsen in 25 years from now. Which can lead people to believe that changes can be made later.
- ***Lack of Control*** – People believe their actions would be too small to make a difference/
- ***Perceived behavioural control*** - Climate change is a global problem, so many individuals feel that they can do nothing about it. This is the well-known collective action problem.
- ***Habit*** – Ingrained behaviours are extremely resistant to permanent change, while others change slowly. [6]

Attitudes tend to align with political viewpoints

Several studies have noted that climate change drifters and denialists tend to be politically conservative, while climate change supporters tend to be left learning, as shown in Figure 3, a poll of Australian voters and their alignment with different parties positions on climate change, produced for the Australian Climate Science Coalition. [7]

While it is over simplistic to conclude that a person's political leanings govern their attitude towards climate change, it may be more the case

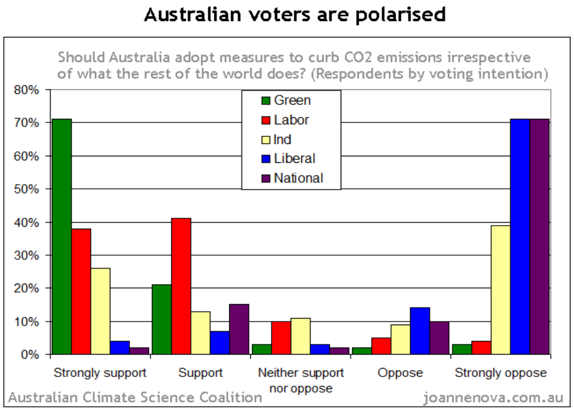

Figure 3: ACSC Poll of Australians attitudes to climate change and political affiliation

that a person's underlying personal philosophy as to whether humans should dominate the planet (anthropocentricism), or live with the planet (geocentricism), is one of the drivers of political ideology and climate change ideology both.

Which brings us back to a need to better understand different people's values, from their perspectives. Public attitudes tend to eventually achieve a natural balance point, that can be distorted in the short-term by information, misinformation and disinformation campaigns. But until that happens climate change drifters will continue to find the messages that best accord with their values.

For those working in science communications, who see the major challenge as being to maximise understanding of global climate change and encourage mitigating behaviours, this appears more likely to be achieved by changing their messages to better align with drifters' values rather than trying to shift the drifters' attitudes through any well-reasoned scientific data or evidence.

Conclusions

So what does it all mean? Well, two key messages:

Firstly, the issue of climate change is a multiple and complex one, or a wicked problem to use a more contemporary expression, and will only be effectively addressed by multiple and complex solutions that bring the multitude of different expert perspectives together, and more effectively work with each other than against each other. It is a matter of increasing the length of the bridge, or bringing all the cells in the panopticon prison together, or putting all the pieces of the jigsaw puzzle together – you choose your favourite metaphor. There is some evidence that we are getting better at this, demonstrated by efforts such as the Australian Science Communicators Hot Air Symposia, which have pooled an enormous amount of data to develop into a guide for communicating the science of climate change.[8]

Secondly, to effectively communicate with any of the many segments of the public, such as climate change drifters, communications must be framed from their perspective and understanding – not the perspective and understanding of scientists nor science communicators.

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Neuroscience: Experience of an Interdisciplinary Dialogue

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Abstract. Looking at the covers of the most important scientific journals or lay magazines published in the last few years an evidence emerges: brain is the favourite subject, its secrets the cover topic. If in the 90s we had the "brain decade", in recent years neurosciencepromises, expectations and doubtshave broken the boundaries of scientific research, reaching the society.Scientific studies and technical advancements in brain science are opening new perspectivesin medicine in terms of diagnosis and therapies. In the meanwhile, new technologies are finding non-clinical applications: the use of brain imagingin the courtroomsis one example.

Scientists, clinicians, patients, philosophers, lawyers, communicators, sociologists, lay people: the number of stakeholders playing a unique role, each one with his own questions, worries, needs, points of view is surprisingly wide. The *bid-brains in dialogue* is a three-year project supported by the EU 7th Framework Programme coordinated by SISSA (Trieste, Italy), that offers occasions and platforms formeetings, discussions and exchanges. Focusingon brain imaging, predictive medicine and brain devices, *bid* has been working since 2008 to address its mainaim: fostering the dialogue between science and society on the new challenges of neuroscience.

The *bid* represents a rare example of project that aims at highlighting the crucial issues in neuroscience through the voices of different people deeply interested in its progress. Several participative methods for discussion have been tested during workshops and public conferences organized in different European locations. From these events, the *bid* staff has produced video interviews, articles on European lay and scientific journals (e.g., "Frontiers in neuroscience" and "EMBO reports") in order to disseminate the information and points of view. All the material is at disposal on a constantly updated website (www.neuromediacorner.eu) where experts and lay people can find news, scientific content, research centres, events, etc.

Despite the interest and efforts of the different stakeholders, it is clear that more dialogue is needed. Voices we listened to do not appear prepared and ready to meet and confront to each other. An improvement in public engagement seemsmore and more urgent to foresee and anticipate future critical debates, situationsand choices at a scientific, socialand political level. Many are the recent examples: just before the *bid*-workshop focused on the scope and limits of brain imaging, a controversy started in US on the use of fMRI to understand the voters' impressionsduring thelast presidential election.Similarly, this year, just after the *bid*-workshop "brains in dialogue on genetic testing", the Food and Drug Administration sent letters to five companies that sell genetic tests directly to consumers ordering them to prove the validity of their products. The paper and the presentation will report the project results and methods as well as the most important topics and crucial issues emerged.

Ewriting Netbred Processes Challenging Intellectual Property Theories and Statutes

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2010
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Abstract. Ewriting (electronic writing) generates theories, practices and computer applications that evolve and continuously redefine our perspective on writing. The genealogy of writing is being redefined considering that mind-net interacions are now prevalent in writing processes. Texts can be printed, digital, web-present, virtual; they are becoming translocal, collective, distributed, interconnected and hyperlinked. Traditionally considered enclosed objects now they can be seen as potential sources for re-information, matrixes for interrelation and reconstruction. In this writing environment, words, phrases, paragraphs would instantaneously reverberate through massive datastructures. Intelligent agents would interact with propositions to pose questions, to alter syntaxes and to make available complementary data. Writings pertaining to similar categories could be automatically interlinked and aggregated so that new content is generated and communities are formed along interests, styles, abilities or customs.

Ewriting tools will challenge deep-rooted cultural habits at the base of our language and thought processes. An intense focus on language will trigger in-depth research into new forms of textual processing. Ewriting reconceives individual authorship into a multi-dividual, socio-machinic, planetwide process. Once ewriting becomes widespread and acknowledged in theory, collective web-based writing, machine-assisted and machine-generated authorship will be investigated as human-developmental tools. Writing, and by extension, thinking, science, design, expression, artmaking, architecture, economics and philosophy will be more and more understood as a dialogical process between human abilities and machine-mediated actions.

As we let our imagination delve into these future forms of thinking, we come to the conclusion that instituted theories, enforced by legal systems, act as insurmountable obstacles to the advancement of creativity, authorship and invention. The problem is that legal theories and legislations, ingrained in almost unchangeable statutes, restrain emerging collaborative authorship models and practices. Thus, current intellectual property values and legal theories will be obliged to readapt to new forms of authorship involving human machine integration.

Keywords: Ewriting, Electronic writing, Theories and practices; Ewriting netbred processes; Authorial web-processes; Intellectual property theories and statutes

Communication for Proactive Environmental Education: Towards Sustainability

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Abstract. One of the major challenges to address the issue of sustainability has been to plan, promote and implement environmental education from initial to higher levels of education world-wide. In accordance with the general framework envisaged in World Environment Education Congress held at Johannesburg and also in tune with other International Organizations although are being implemented elsewhere. Environmental Education is a process of recognizing values and clarifying concepts in order to develop skills and added tools necessary to understand and appreciate the inter-relationship among man, his culture and his bio-physical surrounding. It is expected to create an overall perspective, which acknowledges the fact that natural environment and man-made environment are interdependent. It should consider the environment in its totality and should be a continuous lifelong process beginning at the pre-school level and continuing through all stages. It should be inter-disciplinary and examine major environmental issues from local, national and international points of view. It should utilize various educational approaches to teach and learn about and from the environment with stress on practical activities and first-hand experience. It is through this process of education that people can be sensitized about the environmental issues. Thus effective communication to public becomes more important. This has been envisioned through a national perspective. However the issue of sustainability in a broader frame of Communication to Education and then sustainability of lives and livelihood particularly for the developing world is of paramount importance and public well communicated can effectively contribute in achieving the goals of sustainable development. Thus along with communication the emerging issues of climate change and conservation of natural resources which pivotal for broader issue of sustainable development.

"Stars of Asia" Project

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Abstract. "Stars of Asia"project is one of IYA 2009 activity with collaboration of Asian area. It aims to collect and edit Asian excellent myths and legends relating to stars and universe through the collaboration of Asian countries/regions and then publish attractive books of Asian myths/legends of stars in each country/region for the public, children and teachers, so that many people can enjoy those stories in school, planetarium, and at home.

In 2009, we held the "Stars of Asia Workshop" at NAOJ Mitaka, Tokyo, Japan. The participants brought 65 myths and legends from 14 countries/regions. At the workshop, we organized the Editorial Board nominated from each country/region for editing a book of "Stars of Asia". The members of editorial board are preparing to publish attractive books of Myths and Legends about Stars and the Universe of Asia for children, people, and teachers in Asia and the world. The editorial board edits a common book of "Stars of Asia" in English, then translate to each country/region language, so that we can share rich culture of stars throughout the Asia and Pacific area. The English common book contains 3 parts, *Part I: Myth and Legends of Stars and Universe Loved by Asian People*, *Part II: The Sun, Moon, Stars, Universe, and Human Being*, *Part III: Ancient Astronomy and Universe of Asia*. The editorial board selected several popular stories from each country/region, then laid them out in the part I. Relatively short and classified stories by celestial objects were laid out in the part II. The part III includes the universes of Ancient India and China and traditional way to know the direction and latitude for sailing on the Pacific Ocean. At the end of the book, Origin, Flow and Evolution of Asian Myths and Legends are summarized. In total, the book has about 200 pages with 73 stories.

Not only stories but also illustrations in this book are very attractive. Through the colorful illustration gathering from Asian area, people would feel various cultures and histories of Asia region. Various stories appear from each religion, climate, and geographical features. Contrary, a common story in the wide area, like the story of Vega and Altair exists. It seems to be brought by the racial migration and religious propagation. "Stars of Asia" project may be a first trial to collect myths and legends on stars and universe from the entire Asian region. People can also enjoy the book from a point of view of ethnology.

Measuring Noise Levels in Delhi

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Introduction

Many recent studies have revealed that exposure to environmental noise above the prescribed standards limits have many adverse effects. It enhances the risk of hypertension, ischaemic heart diseases, hearing losses and sleep disorder. Also, it pessimistically influences efficiency and social behavior of a person. Recently, an NGO Chetna filed a case in the Delhi High Court seeking intervention to bring down the noise levels caused due to aircraft engines during landing at the Delhi airport. The extremely high noise levels are causing serious health problems to the residents of the nearby localities. Recognizing in noise pollution a serious hazard to health and efficiency as well as a source of increasing complaints from the public, the measurements of noise levels across Delhi becomes an important study. Based on the analysis of measured data, appropriate measures leading to avoidance, prevention, and reduction of environmental noise can be taken. It will help in bringing eco-friendly environment to the society.

Objectives

The main objectives of the present studies are as follows:

- To measure the noise levels in Delhi
- To compare the measured noise levels with Standard norms
- To identify the significant sources of noise and suggest remedies to reduce the noise levels
- To create public awareness and educating them
- To facilitate the planners and policy makers in taking appropriate decisions

Methodology and Equipment

For measuring the sound levels, Delhi region will be categorized into Residential, Commercial, Industrial, Silent and zones near the airport. The locations will be selected so as to cover all the zones. The measurements will be done in the month of September/October during peak, non-peak and night hours.

The equipment used consists of a sound level meter and a data acquisition system, LabQuest. LabQuest is a stand-alone data collection and analysis device, controlled by the color touch screen and the keys on the front panel. The Sound Level Meter measures sound level in decibels. The measurement range is from 35 to 130 dB with time weighting, frequency weighting and maximum level hold functions. It can be connected to LabQuest through its sensor port. The data recorded by the sound level meter can be stored online into LabQuest for later analysis.

Research on Public Science Literacy in Xiaoguan Communities, Chaoyang, Beijing

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Abstract. In order to understand the basic situation of public science literacy in Beijing communities , in May of 2009, we launched the "citizen science literacy" investigation in xiaoguan street communities, Beijing, China. We took two-stage unequal probability sampling to survey. The recovery of the valid questionnaires was 2100.This paper compares and analyzes survey data and analyzes citizens access to scientific information channel and attitudes to science and technology, which affected the factors of science literacy. It puts forward suggestions as to how to improve communities science literacy.

Key words: Communities population; Science literacy; Survey

Looking for a Media Skill Course Recipe?

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Abstract. Many journalists, communicators, educators, are engaged in Media Skills courses for scientists. The courses offered vary wildly. They range between seminars no longer than a couple of hours to few days long workshops. Some of the courses focus on meeting with video reporters, others prefer to focus on writing techniques. Some courses are designed for senior academic staff, others are directed to early career scientists, that is to say publics with different pressures, needs, and expectations.

To date media skill teachers need to develop their own concepts, produce their own supporting materials and exercises. They often develop exercises based on their own experience or adapting practice from other, similar, courses (ie creative writing courses). Currently, we have no demographic for such courses and involved trainers. We do not know how many of us are involved in this activity, nor with what degree of success, or satisfaction (on both the trainers and the trainees sides).

Journalists, communicators, educators, involved in such activities, along with those who could be interested in developing and promoting these courses, are invited to join this discussion. They are invited to actively participate, presenting their preferred exercises, exposing the obstacles they find in giving the courses, the obstacles found in promoting the courses, the feedback from attendees and institutions. The major goal of the session is that of sharing a set of exercises that have been proved to be successful in teaching scientists to improve dialogue with the media. With a subsequent goal to build an exercise-kit that could be distribute to media skills teachers - the best recipe for a media skill course.

Celebration of Ganesh Festival: Environmental Issues in the State of Maharashtra, India

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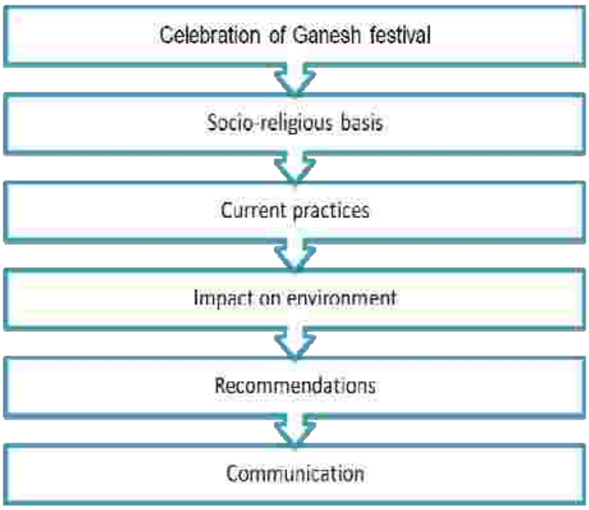
Abstract. India is the country of festivals. The celebration of festivals today has become a subject of discussion. The proposed study enquires into the present state of the celebration of the Ganesh festival in the state of Maharashtra, India. The idealistic rationale behind the celebration of the festival has the socio-religious basis which inculcates among people the sense of unity and integrity. The analytical study of the initial stage of the festival and the current state of celebration indicates a drastic difference. The idealistic rationale seems to have lost and the celebration today is leading to several serious environmental issues. The study investigates the impact of the festival on the environment and presents statistically how it has led to a radical increase in the noise, water and air pollution in recent years. Today many NGOs are working to spread awareness about the issue but the communication has to be at a greater level and hence the masses need to know the hazardous impact of the celebration more effectively. The recommended model (as below) through this study endeavors to create this awareness on a larger scale.



Keywords: Communication, Environmental issues, Ganesh festival, Pollution

Introduction

India is well known for its culture all over the world. The Indian culture is an admixture of diverse cultures within the country. 'It appears as if the inhabitants from the Himalayas in the north to Kanyakumari in the south, and Kutchh in the west to Arunachal in the east are woven together into a beautiful tapestry'.[1] The unique feature of the Indian culture is its unity in diversity. The Indian society is secular and hence accommodates people from diverse socio-religious backgrounds open-heartedly. This discussion on diversity leads us to the varied socio-religious practices and ways of life of people in India. The celebration of innumerable festivals is an outcome of this dynamic socio-cultural set up. People of different religions celebrate the festivals which have been a part of their traditions since ancient times. The Hindus in India are said to celebrate the maximum number of festivals which have been recommended since the Vedic times. The very concept of worshiping the 'Pancha Yajnya', has led to different religious beliefs and practices. The Vedic scriptures such as Manusmriti and Rigvedas have recommended people the ideal ways of life. These practices gradually became larger and social communities started celebrating them on a greater scale. The celebrations of these numerous festivals lead to creating peace, harmony and social and cultural unity among the members of the society. It cannot be denied that these festivals have their base on many prescribed socio-religious concepts and hence they are an integral part of India's unique cultural identity. In modern times also, the people of India celebrate festivals quite vigorously and enthusiastically. It has been observed that in recent times, a majority of people seem to have forgotten the ideal rationale behind the celebration of the festivals and the extravagant celebrations are leading to create several environmental problems. The present study investigates the celebration of the Ganesh festival in the state of Maharashtra and probes into its impact on the environment leading to increase in the leve l of pollution. The major objective of the study is to make recommendations for the more effective mass communication of the eco-friendly Ganesh festival.

Background

The Ganesh festival is celebrated by the Hindus in India in the Hindu month of Bhadrapad (August/September) from the Ganesh Chaturthi (the Day of birth of the lord Ganesh) to the Anant Chaturdashi i.e. usually the period of 10 days.

The tradition of the devotion to Lord Ganesh among the Maharashtrian Hindus can be divided into two categories: a) The Sectarian b) The General or Universal. The sectarian Ganesh devotees (Ganesh Sampraday) can be traced back as early as the sixth and seventh centuries. The sectarian movement was limited to the Brahmins who worshipped Ganesh as their family deity (Kuladaivat) or devoted themselves to Ganesh for reasons of personal choice (Ishtadaivat). The Ganesh cult fully bloomed in Maharashtra during the reign of Brahmin Peshwas (Rulers of the Maratha kingdom in the 18th century). They themselves worshiped Ganesh as their Kuldaivat. They sponsored Ganesh festival during the Hindu month of Bhadrapad (August/September) publicly to demonstrate their religious sentiments and invoke Lord Ganesh to protect them from obstacles. Today this Ganesh cult is limited to the Deshstha and Kokanastha Brahmins.

The general or universal devotion to Lord Ganesh is expressed by Hindus of all castes and sects. Hindus regard him as the 'Over-comer of obstacles'. The Ganesh festival which was restricted only to the Brahmins was brought into public and general observance through the efforts of Bal Gangadhar Tilak in Pune in 1893 as a means of mobilizing large number of Hindus for religious revival and political independence from the clutches of the British. Since then the Ganesh festival has been celebrated quite vigorously and enthusiastically by the Hindus in India.[2] The celebration of the festival today takes place on a larger scale through the intermingling of traditional and modern practices, which have been discussed below.

Traditional practices

The traditional practices can also be called as idealistic practices of the celebration of Ganesh festival as the rationale behind the celebration had been idealistic and the objectives were spiritual and social. Socio-religious integrity has always been an objective of the festival. The festival is celebrated at two levels A) Individual B) Social community. The ritualistic placement of the Ganesh idols on the day of Ganesh chaturthi and the immersion of the idols into water on the day of Anant chaturdashi is the tradional practice. During this period, the idols of Ganesh are worshiped by performing various religious rituals in the houses and the social pandals. On the day of the Anant Chaturdashi, public processions of the Ganesh idols of the social communities are conducted and at the end of the day the idols are immersed in sea, rivers and public lakes and wells.

Modern practices

Although the traditional practices are followed in the modern times also, the celebration has become more extravagant with the increase in population and therefore the number of individuals and social communities. The innumerable Ganesh idols (made of clay and plaster of paris by the local sculptors) are purchased at the individual and social community levels. The celebration of the festival takes place on a huge scale that is leading to several environmental issues. The immersion of the Ganesh idols and other material required to perform rituals lead to cause water pollution whereas the huge loudspeakers played during the whole festival increases noise pollution. The hazards are well-known but are little considered by the masses.

Impact on Environment

The Celebration of Ganesh Festival today, particularly, its immersion process has adverse effects on environment. It causes pollution quite severely, viz. noise, water and air pollution. The present study endeavors to analyse this issue and provide measures and recommendations for their effective communication. The detailed analysis of these 3 types of pollution has been presented in the subsequent points as below.

Noise pollution

The firecrackers used during procession, cause noise pollution. It has adverse effect on the health such as hearing loss (temporary or sometimes permanent), high blood pressure, heart attack and sleeping disturbances.

The drums, music systems used during procession create noise which is very much above the normal level. According to D.B. Smith, 60 dB (decibels) is the normal level of noise during conversation, while 80 dB noise is painful[3]. As illustrated in Table 1, the noise level during Ganesh festival is far above these values.

Table 1: Noise level observed in major cities in Maharashtra during Ganesh Festival

Name of the city	Noise Level in dB 'A'					
	2007		2008		2009	
	Min	Max	Min	Max	Min	Max
Mumbai	63.4	102.7	50.2	91.3	46	105.8
Navi Mumbai	85.9	100.6	51.3	95.8	42.1	93.3
Thane	59.2	92.4	56	96.5	60.1	95
Pune	56.8	99.3	62	107	53.3	101.8
Nashik	40.2	89.3	41.9	99.8	61.5	97.3
Aurang-abad	65.2	114.1	51.3	99.5	41.3	96.5
Nagpur	62.2	98.3	60.7	85.9	53	89.6
Kalyan	65.4	103.8	59.6	92.7	67.8	95.7
Amravati	52.6	93.6	59	79.7	51.7	85.6
Jalgaon	54.0	102.9	60	79	54.5	96.3
Kolhapur	56.9	105.4	65	86	52.9	104.5
Satara	62.5	96.7	66	100	66.1	92.2

(The data is excerpted from the 'Report 2009' of the Maharashtra State Pollution Control Board.[4])

Almost in all major cities, it is approaching to 100 dB. Decrease in trend in noise level is observed in Navi Mumbai and Aurangabad in the last 3 years. It is due to the various citizen awareness programs and campaigns conducted by Maharashtra Pollution Control Board and other Regulatory Agencies.[4] It indicates that if communication is effective and on the larger scale, it will help in improving the situation.

Water pollution

The immersion symbolizes the return of Ganesh from the earth, after removing the obstacles and unhappiness of his devotees. If it is a small idol (upto 1 feet height) which is made up of natural soil, it will not affect the water after immersion. But due to giant sized idols (above 25 feet height), that too, made up of plaster of paris prove to be hazardous to the environment. Also the material used for the decoration purpose is non-degradable that comprises thermocol, plastic which again leads to pollution. All these factors are summarized in Table 2.

The water pollution caused by the immersion affects quite adversely the aquatic life as well. In the nutshell, it could be stated that the immersion of innumerable idols into different water resources causes serious pollution.

Table 2: Effect of immersion process on water

Cause	Contents	Effects
Immersion of idols	---	Block the waterflow resulting in stagnation and breeding of mosquitoes and other harmful pests
Plaster of Paris	Gypsum, sulphur, phosphorus, magnesium	Take several months to dissolve in water and poisons the water of lake, ponds, river, wells etc.
Chemical paints	Mercury, lead, cadmium, carbon	Increases acidity and heavy metal content of water
Decorative material	Thermocol, plastic	Being non-degradable causes pollution of water,

Air pollution

Firecrackers used during the procession lead to air pollution. The chemicals used in firecrackers are harmful to the health of living beings as indicated in Table 3.

Table 3: Effect of firecrackers on health

Chemical	Impact
Copper	Irritation of respiratory tract
Cadmium	Anemia and damage to kidney
Lead	Affects the nervous system
Magnesium	Its dust and fumes cause metal fume fever
Sodium	Reacts violently with moisture and can attack the skin.
Zinc	Leads to vomiting
Nitrate	Could lead to mental impairment
Nitrite	Could lead to coma

(Data Excerpted from the official website of the Kalpavriksh Environment Action Group, Pune[5])

Measures to Save Environment

- The idols of Ganesh should be strictly made of naturally occurring clay (shaadu) which dissolves in water within a few hours after immersion.
- 'One idol per village or area or housing society' will reduce the number of idols to be immersed. It is to be noted that nearly 1.5 crore idols are immersed in the major cities of Maharashtra.
- The immersion should be done at home in a small water tank and the clay can be utilized

for plants. This will avoid the pollution of the natural water resources such as sea, rivers and lakes.

- Instead of immersing idols, betel nut which symbolizes the idol may be immersed. The same idol can be used every year.
- Use of permanent idols such as idols made of metal, silver, marble stone will avoid water pollution.
- Natural colours should be used for the idols.
- The decoration material should also be incurred from natural resources i.e. flowers and paper etc. The use of thermocol and plastic should strictly be avoided.
- The material used for the rituals during the festival should not be disposed of in water.
- The use of loud speakers and music systems should be strictly prohibited by law to avoid noise pollution.
- There should be control on the use of crackers during the festival.
- It is a responsibility of the individuals to limit the use of colours during the procession as they have harmful effects on skin and eyes.

Recommendations

As the measures suggested above are important and even several NGOs and Government agencies try to spread awareness about them, it has been observed that the implementation of these measures fails to a greater extent. The extravagance of the celebration of this spiritual festival continues to degrade the environment and increase the levels of pollution. The problem identified through the study is the ineffective communication of these measures which must be communicated effectively if they are to be implemented successfully. Several NGOs and Government agencies are trying to communicate the measures to masses but the communication needs to be done on a greater scale. The recommendations for the effective communication of these measures are presented as below:

- All these measures can be incorporated in the syllabus of the subject ‘Environmental studies’ in primary schools and colleges.
- Awareness programmes such as slide-show presentations, street-plays can be organized on a greater scale in schools, colleges and at public places.
- The government agencies, NGOs, schools and colleges may form groups for carrying out such awareness programmes on a greater scale.
- Small video clips can be shown in the cinema halls before the movie starts or during intervals.
- The video clips may also be shown on national television for spreading awareness.
- Leaflets describing the measures can be circulated a few days before the Ganesh festival through newspapers.
- Posters and hoardings communicating the measures may also be displayed at public places.
- Banners prohibiting the immersion of idols may be displayed at seas, rivers, lakes and ponds.
- The print media such as newspapers and magazines may publish the measures for the eco-friendly Ganesh festival.
- A documentary showcasing the harmful impact of the current practices should be prepared and shown at public places.
- Public announcements regarding the Dos and Don’ts may be made before and during the festival.

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Multipronged Approach for Popularization of Science and Technology among the public

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Abstract: The rate at which Science and Technology is advancing in the world is simply unimaginable. It needs superhuman efforts to communicate Science and Technology to the public. However a large number of steps are already being taken by Govt. and Non-Govt. organisations in this regard. Yet it is inadequate. One solution appears to be to make it a mass movement. For this a multipronged approach may be made to expose and train the heads/leaders of various groups who can take Science and Technology down to the individuals at grass-root level.

Keywords: Mass movement, MP, MLA, Multipronged approach, NCSC, Panchayat Raj, People's representatives, Science centres, Student

Introduction

A glimpse at the steps taken in the past for popularisation of science by Govt. and Non-Govt agencies would indicate that, perhaps no stone has been unturned in this regard. Some are useful, some very useful and some are excellent.

Pamphlets, Leaflets, Articles in Print Media; Books, Magazines, Radio, Television, Talks, Debates, Jathas, Slogans, Morchas, Posters, Flagmarch with placards, Exhibitions, Museums, Quiz Competitions, science based Cultural programs and Folk art etc; are only indicative and not exhaustive. Prizes are also awarded as incentives for all these. Yet, it appears, there is much more that can be done.

Can this be converted to a mass movement - a movement to which people from all walks of life can be roped in? They can be made to be actually involved and contribute significantly in their own way.

Multipronged approach

Yes! It is possible. For this we can have a multipronged approach. We have to identify the groups, create awareness among their leaders/heads and train them. An approach can be to identify them by their age group, level of education, their pursuits of daily life, vocation, profession etc. For example, we have students, teachers, doctors, politicians, peoples' representatives, administrators, assistants, scientists, business people, corporate houses, social workers/self help groups, women groups, tribal groups, industrialists, labourers in organised and unorganised sectors; armed forces of all wings and paramilitary forces etc.

These different groups have different levels of education, understanding, exposure and interest. Hence while taking science to them; we have to adopt different approaches, strategies, methodology, techniques and mediums.

One can design and distribute leaflets, booklets, documents for different groups, organise meetings, training programs, workshops and interactive sessions. The duration of the programmes can be varied, from a few hours to a few days and spread in different locations. For top echelons, we may choose Secretariat Conference Room, Administrative Academies; for MLA's, Assembly or suitable Halls; for MPs, Conference Halls; for Collectors/Block Level Officers, collectorate conference halls and so on. For the grass root level, there are respective Panchayati Raj office premises. These meetings or workshops can be repeated for different groups.

The leaders in turn can take suitable steps for bringing science to the groups they head, formulate programs within their scope for inculcating scientific temper, removal of superstition and blind beliefs as well appreciation of scientific activities & achievements at different levels.

Experience

The approach indicated above is based on some experience we had way back almost three decades hence in the Department of Science Technology and Environment when a massive program was launched for creating awareness on Environment, various issues involved, steps to be taken at different levels, the roles to be played by the various groups and individuals, policies to be advocated for adoption by Govt. etc. A number of incentives and awards were instituted. These have since become a part of the system and have done yeoman service for creating an impact on protection of the Environment in the State.

Another program recently organised by the P S Planetarium, under the aegis of DST, GOO is 'Scientific Exposure Visit' for students selected from schools under Tribal Sub Plan of the state. One student from each of the 254 schools are brought to Bhubaneswar, accompanied by some teachers and camped for four days. During this period, eminent scientists gave talks, visit to scientific institutes, like Institute of Physics, IMS, PSP, RSC, RMNH etc; were organised. Participants made notes on their observations and had interactive sessions at the end of the day. Selected students were awarded prizes at the Valedictory function. This is the 2nd year in succession. The participants had a rich experience which was communicated to their school mates. Let us consider some of the groups:

Students

Students constitute the major part of the society. As the future generation of the country, this group deserves maximum attention. Rightly so, a large number of programmes are being implemented. Besides science as a part of the curriculum, the other programmes are Science Exhibition talks or lectures, various competitions, National Children's Science Congress–starting from individual schools to National Level participation with a focussed theme, Science Centres under NCSM, though vary few in numbers; observation of various National Days like NSD, World Environment Day, Technology Day, Science Express, though only a small section is benefitted; Programmes on TSP, Olympiads and so on. Yet a few more things can also be done. More science based programmes can be broadcast by Radio, which will reach remote corners where there is limited scope for TV. The scope of students from remote areas to visit Science Centres, Planetaria may be increased. Mobile Science vans and Mobile Planetaria may be increased. Popular Science Magazines in local languages already available at subsidised rates may be sent to interior schools possibly at highly subsidised rates.

People's Representatives:

India is a democratic country. Policies are made by People's Representatives. Government Machinery is run by a vast network of committed Bureaucracy, overviewed by People's Representatives. They are the persons who interact with people whom they represent. Hence Science should reach them first so that they can appreciate the programmes and in turn take them to the people. That is the way their outlook will change to at least at limited extent, overcome superstition and blind belief, creating awareness of Health, Hygiene and Sanitation and protect the environment.

- At National Level: Members of Parliament; Members of Rajya Sabha
- At State Level: Members of Legislative Assembly
- At Municipality/Corporation/NAC Level: Councillors/Mayors, Chairpersons
- At Panchayat Level: Panchayats/Sarpanch

The Panchayati Raj is a system which enables people to run their own local Govt in rural areas.

The Panchayati Raj is a three tier system. It works at three levels–

- The gram panchayat at the village level,
- The block samiti at the block level and
- The zilla parishad at the district level

In our country, the system of Panchayats is very old. In 1992, the Central Govt. Amended the Constitution and formulated rules for the Panchayati Raj System. These rules became effective from April 1993.

The Gram Panchayat has various duties with emphasis on developmental activities such as agriculture, primary education, health and sanitation and responsible for implementing the Community Development Programme at village level.

- Block Samiti–Elected members + State Legislative Members + Members of Parliament of that area
- Zilla Parishad–Apex body of the PR System. Elected body + MLA + MP
- These institutes of Local Self Govt. also help to bring about social change.

Local Self Govt. in Urban Areas

A Municipality or Municipal Council is Local Self Govt. body in smaller towns and cities. The population of a town or city determines the number of members in the Municipality (usually in between 15 to 16). A head of the Municipality is called Commissioner or President.

In case of large cities, the Local Self Govt. body is called Municipal Corporation. The number of elected members is usually between 50 and 100 (may be more as in Delhi and Mumbai – 134 to 221). The head is known as Mahapur or Mayor. The functions are:

1. Maintenance of public hygiene
2. Public Health
3. Public conveniences
4. Registering Births and Deaths
5. Education
6. Roads and Bridges
7. Solid Waste Management

Note: A Nagar Panchayat is set up for an area that is changing from a rural to an urban type – Transitional area.

State Legislature

- Legislative Assembly (Vidhan Sabha or Lower House)–The strength of State Legislature varies according to the population of the State concerned. The total strength for all States/UTs in India is 1485.
- Legislative Council (Vidhan Parishad or Upper House)–The strength varies as per the population of the State, limited to 1/3rd of the strength of Legislative Assembly.

Parliament

- Lok Sabha: Maximum strength is 550 + 2 nominated members (530 States and 20 Union Territories).
- Rajya Sabha: Maximun strength is 250.

In the preceding paragraphs, we have mentioned the People's Representatives of various categories starting from Panchayat Raj to Parliament. This indicates how effective our approach would be if they are individually and severally groomed in Science and Technology by way of exposure and training, however short they may be.

Women's Group

Currently with the support from different programs at State and National level, several Women groups have become active and undertaking activities for socio-economic development.

We may focus S&T communication for this group which will be very effective in achieving our objective.

Tribal Group

The Tribal Group constitute a significant percentage of the population in several States. Along with the development programs they may be exposed to Science and Technology in an appropriate manner to appreciate the role of S&T for Social-Economic development and well being besides developing a scientific temper and removal of superstition.

In addition to the above, there is another group/section that may also be roped in. They are the officers of Major Corporations who contribute to programme of Social Relevance. In fact the Social Corporate Responsibility is now a programme built into the system/organisation. They are already doing yeoman service for the welfare of the society where they are active.

Conclusion

For effective communication of Science and Technology to the public, there should be a mass movement and a Multipronged Approach is highly recommended.

Public Perception of S&T and Public Policies for Science Communication in Brazil

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Abstract. In this communication we will present the results of a recent survey (June 2010) on public perception of science and technology (S&T) in Brazil. The results will be compared with a similar survey realized four years ago. This survey was conducted by the Ministry of Science and Technology, with the collaboration of Museum of Life/Fiocruz. The interviews were realized by using a structured questionnaire with a statistically representative sample of Brazilian population aged 16 and over (2,016 respondents, with an estimated confidence interval of 95%). The questionnaire includes 24 questions, split in three sections: (i) evaluation of the interest and consumption of information on S&T; (ii) attitudes and visions on S&T; (iii) evaluation and knowledge on the situation of Brazilian science.

The survey showed that Brazilians have a good level of interest in S&T, similar to their interests in sports or economy. Medicine and health and the environmental problem were the issues with the biggest interest. One of the survey's main objectives was to map out how the Brazilian public engages with S&T; for example, visiting scientific-cultural institutions or participating in any S&T-related event in the past year. Just 8,3% had visited science centers and museums; the figure was 4% in the 2006 survey showing a significant growing in the last four years. This number of visitors depends strongly of the social class and education. About 4,8% took part in activities of the National S&T Week (3% in the 2006 survey). Brazilians seem to have a definitely positive and optimistic view on science: about 82% said S&T brings only benefits or more benefits than harm for society. This view is general, and does not vary significantly with people's education or social class. The main concerns about the use of S&T were related to negative environmental impacts, followed by the reduction of the employment.

Quantitative surveys have obvious limitations. For instance, they supply an instantaneous picture, without mapping out key information on the dynamic process of the engagement between science and society. These studies need to be complemented by qualitative studies, providing deeper analyses of the motivations, viewpoints and reactions of selected social groups toward S&T. We will discuss also how these surveys have been used for improving public policies and for the design of more effective science education and science communication strategies and programs. For instance, results of the 2006 survey were used within the Plan of Action for Science, Technology and Innovation for National Development (2007-2010) in the establishment of programs for the creation of new science centers around the country. These surveys can also provide useful information and political inputs for improving social inclusion and democratizing knowledge.

ICT Mediated Knowledge Share Centres for Localized Extension Services in Rainfed Agriculture

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Abstract. In the present era of knowledge revolution there is a need to equip farmers with changing scenario of dynamic information acquisition, communication and utilization. ICT mediated need based location specific communication in rainfed agriculture integrates the information, communication, dissemination and adoption for sustainable agricultural development .Use of ICT's in combination with different media like TV, bulletins, posters etc,. exhibit multifaceted dimensions and multifarious roles for technology access particularly in communicating to farmers.

With this background, ICT's component is included in the CRIDA's NAIP project on "Sustainable rural livelihoods through enhanced farming systems productivity and efficient support systems in rainfed areas" which is an action research pilot project in selected village clusters of the 8 backward districts of Andhra Pradesh involving a consortium of institutions from public, private and NGO sectors. Efforts are made in the project to open the avenues for technology access and utilization in the rural areas to the clientele. Realizing the importance of ICT's in this juncture, one of the specific objectives of the project is "Capacity building and skill development of primary and secondary stakeholders through knowledge sharing, collective action and use of modern ICTs". The present note reveals how the knowledge resources in combination with media enabled ICTs are used in the project to harness technology communication and utilization by rural masses

For better utilization of the services, informal institutional set up with three tier structure i.e *Information Knowledge & utilization (IKU) groups* at village / grassroot level for utilizing the knowledge resources diffused , *Knowledge share Centres (KSC) at cluster level* to disseminate and communicate the knowledge & information generated and *Knowledge Resource centers (KRC) at apex level* to generate knowledge / technology resources and content based on clientele needs assessment & Participatory rural appraisal (PRA) is being promoted under the initiative. User-friendly information through touch screen kiosks (TSK), queries readdressal system through interactive voice response system (IVRS), awareness creation of the technologies through display announcement package (DAP), Internet etc, are the services of the KSC. The KSC platform combines technologies, knowledge and multiple media such as television, print media to bring vital information regarding crop management practices, local weather, prices in local markets to communicate meaningful information & knowledge to farmers

Efforts are made in the project to provide localized knowledge as expressed by the rural community during situation analysis by PRA, focus group interactions FGI and information needs assessment INA. The content was then designed based on the PRA, INA etc, in an user friendly interactive format for crop diagnostic services, crop calendars, package of practices, weather alerts, market information etc, two years experience from the project states that media in combination with ICT's for technology transfer communication with farmers and knowledge enhancement with attributes of compatibility, profitability, amenable to local situations and regular updates of technology is need of hour for better outreach and adoption.

A Study on Uses of ICT in the Agriculture Field in Tiruchirappalli District

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Abstract. Agriculture is considered as primary occupation for a major segment of population in India. A vast majority of rural population depends upon agriculture. But now agriculture is in depression and needs rejuvenation. The agricultural sector in India is currently passing through a difficult phase. India is moving towards an agricultural emergency due to lack of attention, insufficient land reforms, defective land management, non-providing of fair prices to farmers for their crops, inadequate investment in irrigational and agricultural infrastructure in India, etc. India's food production and productivity is declining while its food consumption is increasing.

The ultimate solution to this problem is the use of ICT in the agriculture field at the grass root and ground level. India's food production and productivity may be increased by an effective use of ICT for agricultural purposes. The developed nations are using laser technology instead of tractors to plough lands. This helps in optimizing the use of various inputs such as water, seeds, fertilizers, etc. The problem is that Indian farmers cannot afford this technology and unless government comes in support for agricultural infrastructure, the same remains a dream only.

For instance, panchayats should encourage cooperative farming, power and irrigational facilities must be provided to the farmers, easy and effective financial access must be provided to the farmers, direct marketing and sale must be adopted by farmers, public investment in agricultural infrastructure must be enhanced, a minimum support price for food grains must be set, etc. Finally, farmers in India must use Information and Information Technology (ICT) for agricultural purposes.

Further, power and electricity also remains a major problem for Indian farmers and alternative means of power like solar energy panels, regulated and optimised by ICT, can be a blessing for them. Thus, e- agriculture can put India on the higher pedestal of Green Resolution making India self-sufficient in the matters of food grains.

Some of the benefits of ICT for the improvement and strengthening of agriculture sector in India include timely information on weather forecasts and calamities, better and spontaneous agricultural practices, better marketing exposure and pricing, reduction of agricultural risks and enhanced incomes, better awareness and information, improved networking and communication, facility of online trading and e-commerce, better representation at various forums, authorities and platform, etc. E-agriculture can play a major role in the increased food production and productivity in India.

Study of the Education Environment Factors Affecting the Creative Imagination of School Students in China

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Abstract. The purpose of this study is to investigate the education environment factors which either stimulate or inhibit the development of creative imagination of school student in China. The instrument was The Test of Creative Imagination which developed by our group. All participants consisted of 70 students who come from two schools sited in Cheng Du city in Sichuan province in China. Based on the findings of this study, we conclude that these strategies can improve students' creative imagination, such as inquiry based teaching; student-center; group discussion; utilizing computer in teaching. However, large amount exercises, memorizing and repeating from textbooks will destroy students' creative imagination. We also conclude that students have a certain fear as well as get supportive attitudes from teachers will be beneficial to improve their creative imagination. Sufficient books are good to students' creative imagination. Internet access has two sides' effects on creative imagination of students. We also propose some suggestions for teachers.

Summary of the Eighth Science Literacy Survey in China

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Abstract. It has been carried out a total of eight national public scientific literacy surveys in China since 1992, and the sample number of the most recent scientific literacy survey of Chinese citizens–the 8th Science Literacy Survey was up to 69,360. The main results have been formally released after it was finished in May 2010. This paper introduced the methods of sample design, process control and data processing of the 8th Science Literacy Survey, as well as the differences from the previous surveys. The results of this survey indicated that the level of scientific literacy of Chinese citizens has increased steadily, and the ratio of the Chinese citizens with scientific literacy has been up to 3.27% by 2010. The mass media channels by which Chinese citizens use to get scientific information are becoming more and more diverse, especially the proportion of using emerging modern media such as Internet increased obviously. There were higher proportions of Chinese citizens visiting the science and technology museums and participating in science activities. Chinese citizens held positive attitude towards science and technology and in the minds of Chinese citizens, the prestige of science and technology related occupations was higher than other occupations.

On the Children's Science Communication

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Abstract. Science communication is an emerging academic field, this paper outlines the concept of scientific communication, focusing on their science for the public to describe the spread of this side, popular science lectures in science communication in the role. At the same time the huge crowd for the primary audience, how to implement science communication and science communication from the current level of children, explain the existence of popular science lectures and commitment to be confusion problems, and to localize the actual science communication, an overview of the town school children how to carry out some of the practices of science communication.

Keywords: Science lecture, Spread

The Classics of Science in P. R. China

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Abstract. From the 1950s to the 1970s, China has experienced a Natural Science Critique Movement, which lasted more than 20 years. With the start of this movement, some classics of science were successively translated into Chinese and got published. In the 1950s, China and the Soviet Union became socialist allies. So in the field of natural science, China was strongly influenced by the Soviet Union's ideology. Therefore, how to select the classics of science followed two standards. One was to select the works which had be commended or criticized in *Dialectics of Nature* by F. Engels or *Materialism and Empiriocriticism* by V. Lenin (both books were seen as the philosophical guides of the natural science then), and the other was to be commended or criticized in the Soviet Union. At that time, these two standards were clearly reflected in the Sovietization of the Chinese college textbook. In the early 1960s, the alliance between China and the Soviet Union broke, but incredibly, Some Western classics of science became appreciated—Works of A. Einstein, E. Schrodinger, N. Bohr got published one after another, and some of them even became college textbooks. In the period of complete confrontation between China and the West, this phenomenon seems a little strange. In 1966, China launched a decade-long Cultural Revolution, in which the proletariat ideology and the bourgeoisie ideology struggled each other. Thus, in the field of the natural science, some Western theories of science were seen as idealism and metaphysics theories of the bourgeoisie. The publications of many classics of science became class struggle tools by which the Proletarian combated against the Bourgeois ideology. This situation lasted from the early 1970s to the end of 1976, when the Cultural Revolution was over.

In the 1980s of the 20th century, China entered a new period of reform and opening-up. Some classics of science had been translated into Chinese and got published since then. To respect the history, these works were required to "try to maintain the original style in the translation". In this period, the publication of classics of science began to be deideological. In the 21st century, the government of China has strongly supported the publication of the classics of science, which have been accepted as the National Key Books and subsidized by government funds. This effort of the Government, on the one hand, is trying to inherit the great cultural heritage of human history, improve the public's scientific literacy and earn the public’s recognition of the spiritual values of the science, and on the other hand, is trying to speed up the reform of the college education system deeply influenced by the Soviet Union’s, and urge the college education system to shift from special model to general model.

This article explored the communication history of the classics of science in China in the past 60 years, and inquired the complex relationship among the science, philosophy, ideology and education reform in China.

The Effects Assessment of "the Project on Science Popularization Benefiting Peasants and Prospering the Rural" in China

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Abstract. "The project on science popularization benefiting peasants and prospering the rural" is a new mode of popularizing science and technology for villages in China, which aims to heighten peasants' science literacy and promote the development of rural economy and society. The project has been implemented for three years from 2006 to 2008. In order to evaluate the project and its effects objectively, China Research Institute for Science Popularization has developed an evaluation index system. We explore to use a method of comprehensive grading and adopted a combination of self-evaluation and the assessment of the project group in conjunction with the experts to evaluate the effects that the project has brought about in some typical regions, meanwhile analyze the results of assessment deep.

Keywords: Science Popularization, Peasants, Rural China

Thoughts on Problems on the Boundary of Science Communication–From Several Examples in China

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Abstract. This article discusses some problems on the boundary of science communication in China, and also, defines a new boundary according to some characters of science communication recently. So far away from the center of science, the situation on the boundary is quite different. On the other hand, this study is not as the study about the boundary of science as well, for science and science communication are totally different topics. Science has long been the way that people deal with nature, yet science communication is related to the field of humanities. It must care about this relationship and even build on the relationship between the two to obtain the effect they want. As a result, the boundary of science is certainly complex, not as one always think. And it is worth studying, because standing in this field, it is hard to us to get the identification: whether something is science communication or not. However, What I have to emphasize is that before we gain enough achievements in examples' research, we can never imagine any regular about the boundary, we need amount of evidence. In this article, I tried to give some examples which are really on the boundary of science communication. At least I consider the situation in China is like this, and some of such examples also suit to some other countries. I believe thanks to the influence of culture, each race or culture owner must have their characteristic boundary of science communication. At the end of the article, I gave some example in detail to show some character from them. From those examples of Chinese seal-cutting, I hope to show the flexibility of science communication clearly. Furthermore I think it can support my conclusion about the boundary of science communication: its appearance is not the filament, but the glow.

Keywords: Boundary; Science communication; Science and art

Information Seeking Behaviour of Tapioca (Cassava) Growers in Salem District

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Abstract. This paper is an outcome of the research study conducted by the authors on information seeking behavior of tapioca growers in Salem District, Tamilnadu, India. Data were collected by using face-to-face interview method and analyzed by using the latest version of SPSS Package for appropriate statistical procedures for the description. This study discusses the findings of various strategies and procedures adopted by the tapioca growers in meeting their information requirements through different channels. The objective of the study was to ascertain the association between information seeking behavior of farmers and their personal characteristics.

Keyword: Agricultural information systems, Information seeking, Information behaviour, Information sources, Tapioca

Introduction

Information seeking is a human process that requires adaptive and reflective control over the afferent and efferent actions of the information seeker. The study on information seeking behavior includes: the strategies people adopt for making discoveries, their expectations, attitudes, anxieties, promotion of relationships as they live and work with other information users. Information seekers should begin with finding out the obstacles which deter progress, thereby creating an information gap / vacuum. An important aspect of sense making is a process in which people struggle to understand a problem that drives them to seek meaning; for in many situations and many circumstances they are content to take no such action.

Therefore the need arises to find out if the tapioca growers are able to obtain the information they need as they go about searching for relevant and pertinent information. It is also important to find out what methods and sources of information they usually utilize while trying to meet their objectives. Sequel to these reasons, the researcher also studies the information and utilization patterns among tapioca growers in Tamilnadu.

Methodology

This study involved data collection and analysis purely based on the primary sources of information available from registered tapioca growers of the factory in Salem District. The registered tapioca growers of the factory were listed and stratified into three categories such as small, medium and large scale farmers. From the registered Tapioca growers, 117 sample respondents were selected at random. The primary data were collected with the help of pretested structured schedule by holding personal interview regarding utilization of information sources, knowledge level and socio-economic characteristics of the Tapioca growers. Thus the sample consisted of farmer’s observations among the factories in Salem district.

Objectives

1. To study the role of existing information sources and knowledge level of the tapioca growers.
2. To examine the socio-economic characteristics and the problems faced by the Tapioca growers.
3. To find out the problems faced by the tapioca growers of Salem district in utilizing the information through agricultural research center.
4. To find out the utilization of credit facility by the Tapioca farmers of salem district.
5. To identify the constraints and provide suggestions for improving the existing information system.

Hypothesis

1. Tapioca farmers differ in their educational status on the basis of their land size.
2. Tapioca farmers differ in their knowledge level of tapioca cultivation practices.
3. Tapioca farmers differ in their level of utilization of inter personal sources.
4. Tapioca farmers do not differ in their level of attending training programmes.
5. Tapioca farmers do not differ in the problems faced by them in utilizing the information secured from training programmes.
6. Tapioca farmers do not differ in the problems faced in utilizing information

through Tamilnadu Agricultural Research Center.

Result and Discussion

Table: 1 Distribution of respondents according to the educational status

S.No.	Categories of Tapioca Farmers	Ill	Can Read Only	Pri	Mid	High	High Sec	College	Total	X^2	DF	LS
01	Small	14 (11.96)	4 (3.42)	8 (6.83)	3 (2.56)	5 (4.27)	4 (3.41)	2 (1.71)	40 (34.18)	64.45	12	0.01
02	Medium	12 (10.26)	3 (2.56)	5 (4.27)	4 (3.42)	4 (3.42)	6 (5.12)	3 (2.56)	37 (31.64)			
03	Large	3 (2.56)	2 (1.71)	6 (5.12)	5 (4.27)	6 (5.12)	6 (5.12)	12 (10.26)	40 (34.18)			
	Total	29 (24.77)	9 (7.7)	19 (16.24)	12 (10.25)	15 (12.82)	16 (13.68)	17 (14.54)	117 (100)			

Hypothesis: Farmers differ in their educational status on the basis of their land size. As per the table among the various groups of farmers, High School level education is found more in large farmers. Illiteracy is found more in small and medium groups. Middle level education is more in medium farmers and college level education is more in large farmers. This difference is confirmed by the chi-square (64.45) obtained, which is significant at 1% level.

Table: 2 Knowledge level of tapioca growers in cultivation practices

S. No.	Categories of Sugar Cane Farmers	SBTT Treatments	Fertilizer Application	Weed Control	Pest And Diseases Control	Inter Cultivation Practice	Irrigation Management	Total
1	Small	6	12	5	5	4	8	40
2	Medium	4	10	3	5	6	9	37
3	Large	14	8	3	5	6	4	40
	Total	24	30	11	16	15	21	117

Hypothesis: Tapioca farmers differ in their knowledge level of tapioca cultivation practices.

Calculated Chi-square Value = 19.44
Degrees of Freedom = 10
Level of Significance = 0.01

It is observed from the above table that irrespective of their farm size, majority of them have more knowledge in fertilizer application followed by SBTT treatments and weed control. But among the different groups of farmers, small and medium farmers have more knowledge in fertilizer application, but large group farmers have more knowledge in SBTT treatments. This difference is confirmed by the obtained Chi-square value, which is significant at 1% level. Hence the stated hypothesis is accepted.

Table: 3 Utilization of Mass Media Sources

S. No	Categories of Tapioca Farmers	Utilization of Mass Media Sources										Total
		Radio		TV		Newspaper		Magazines/ Journals		Films and Video		
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
1	Small	32	8	26	14	18	22	9	31	30	10	40
2	Medium	28	9	25	12	21	19	12	25	29	8	37
3	Large	26	14	23	16	24	16	21	19	25	15	40
	Total	86	31	74	42	63	57	42	25	84	33	170
		73.5%	26.5%	63.2%	36.8%	53.8%	46.2%	35.9%	64.1%	71.8%	28.2%	

It is seen from the table given above that, among the various sources of utilization of mass media majority of them receive knowledge through Radio (73.5%) followed by film and video (71.8%) and T.V (63.2%) irrespective of their land size. On the basis of their groups, small group farmers utilized radio more; large group farmers utilized radio, film and medium group farmers use radio, video more. So majority of the tapioca farmers receive information through radio, films and video.

Table: 4 Problems faced by the tapioca growers in utilizing the information obtained from training programmes.

S. No.	Categories of Tapioca Growers	No Information About source	Insufficient Time	No village Based Training.	Difficulties To Understand	Other	Total
1	Small	5	6	20	6	-	37
2	Medium	8	3	26	3	-	40
3	Large	6	5	21	8	-	40
	Total	19 (16.2%)	14 (12.0%)	67 (57.3%)	17 (14.5%)	-	117 (100%)

Calculated Chi-square Value = 4.690
Degrees of Freedom = 6
Level of Significance = Non significant

Hypothesis: Farmers do not differ in the problems faced by them in utilizing information from training programmes.

Regarding the problems faced by the tapioca growers in utilizing the information obtained from training programmes, it is observed from the above table that, irrespective of their categories, 57.3% of the farmers have told that the training programmes are not village based. 16.2% of them have no information about source, 12.0% of them complained of insufficient time, and 14.5% of them found it difficult to understand. This difference is not confirmed by the obtained Chi-square value, which is non-significant. Hence the stated hypothesis is accepted.

Table: 5 Problems faced by the tapioca growers in utilizing the information through Tamilnadu Agricultural Research Center

S. No	Categories of Tapioca farmers	Yes	No	Total
1	Small	28	12	40
2	Medium	26	11	37
3	Large	32	8	40
	Total	86 (73.5%)	31 (26.5%)	117 (100%)

Calculated Chi-square Value = 1.158
Degrees of Freedom = 2
Level of Significance = Non significant

Hypothesis: Farmers do not differ in the problems faced by utilizing the information received through Tamilnadu Agricultural Research Center.

It is seen from the table that irrespective of the categories 73.5% of the farmers face problems. But 26.5% of them did not face any problem. Category wise more number of medium group farmers did not face any problem. This difference is not confirmed, because it is non-significant. So the hypothesis is accepted.

Finding and Conclusion

- Out of the 117 samples selected for this study the following were the findings.
- Only large size tapioca growers have the higher level of education i.e. , high school education and above.
- One fourth of the tapioca farmers have good experience in fertilizer application when compared to the other aspects of tapioca cultivation.
- Radio, films and video programmes and TV are the media mostly used by the tapioca growers.
- Majority of the tapioca growers (66.6%) have not attended the training programmes. Only large farmers attended the training programmes.

Suggestions

1. The farmers are not having frequent contacts with the staff of state agricultural department and this should be increased.
2. There should be a regular meeting with the staff of tapioca research centre, staff of state agricultural department, tapioca officers, development officers of sago serve factory for the purpose of exchanging information on latest technology.
3. The telecasting time for agricultural related programmes should be convenient for farmers i.e., it should be after 7p.m in seasons like sowing, harvesting etc.
4. The villages concerned with the sago industries should be developed to a good extent i.e., provisions of formal education at least upto higher secondary level and also health centers.
5. The local library should be well equipped with materials pertaining to agricultural information and the farmers should be motivated to use these materials.
6. The Government should provide subsidies for the farmers who use new techniques in tapioca cultivation.

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Science Communication by Dialogue Through Mass Media

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Abstract. Normally science communication is taken as the dissemination of science and technology through a one way communication flowing from the author/ presenter to the target reader/audience. This limits the scope of dissemination without leaving any room for getting the doubts on the subject clarified. If the dissemination is done through a dialogue there is ample scope for the recipient of the scientific information to seek clarification and get the doubts cleared.

Having decided that the dissemination of science and technology is by a dialogue, the ways to make it a dialogue have to be explored When we start exploring the means for a dialogue, the available avenues of mass media line themselves in. Defining the mass media, various types of mass media and the mode of science communicatin as a two dialogue using these media will be discussed in this paper.

Keywords: Science communication, Two-way dialogue, Mass media, science communication Dialogue in mass media

Defining Mass Media

Mass media is any medium which is used to transit.mass communication. Presently it may be taken as the medium used to transmit science communication. Books, newspapers, magazines, recordings, radio, television and the internet all can act as a medium to transmit science communication.

The above list is not exhaustive as the new kinds of medium like mobile phone communication, video games are still evolving as the technology is advancing leaps and bounds to make these as emerging mediums in addition to the already existing mass media.

Devising A Dialogue in Mass Media

As we want the science communication to take place two-way between presenter and the target audience, readers as the case may be it has to be a conversation or dialogue. A dialogue may be ingeniously devised in all the foregoing mediums. Radio, television and internet offer easier ways of creating dialogues for dissemination of science. We are going to study in detail each of the mass media to see the roles played each of them.

Radio and Television

Radio was the foremost In electronic media carrying programmes live to the listeners. Science programmes like science snippets, science news may be aired to the listeners as a one way communication. Discussions and interviews on science topics like global warming are dialogues between participants in the programme itself. The real dialogue takes place only when the listeners directly participates in the programme. A live feed via phone may be fed into the programme enabling listeners to phone in their questions, answers and opinions on the live discussions on the programme. This way all other listeners may clarify their doubts if any as their representative lot from the listeners side participate in the conversation.

Television has taken over as the foremost medium for programmes aired via radio. The viewers get to see the participants, the interviewer, announcer, anchor all live on the television screen. Scientifically educative programmes on AIDS awareness, prevention and cure, topical epidemic like dengue fever, bird flu, super bug may all be make as programmes with viewers participation both as part of the panel and or as interacting views with live phone in to the studios.

The Internet

The internet arrived on the scene of information flow with a bang, rightly termed the information super highway providing information on every conceivable subject. Science and Technology dissemination had been never so easy after the advent of the net. Search engines spew out the hundreds of thousands of sites for disseminating science and technical information. Again coming to the two way communication, the sites disseminating science and tech may put up blogs, articles with a provision for live loading of the comments by the readers. The author then can answer any query by the readers. Even the readers may put in their expert comments if they are well versed in the subject. The beauty of net is it’s accessibility anywhere any time. That makes it an excellent medium for two way dialogue of science and technology on a 24X7 basis.

The Physically Flipped Newspapers and Magazines

The newspapers and magazines constitute the print media. They are read at leisurely medium for the science communication , physically flipped by the readers. They are not live when compared to the electronic media like radio and television. When viewed as a two way dialogue medium for science communication they are less favoured. Even then the newspapers and magazines may be used to involve the readers ingeniously. The readers participation may be solicited by rewarding the best questions and best answers from them. A contest may be announced for this purpose.

The Mobile Revolution in Science and Technology Dissemination

The information dissemination received a shot in the arm by the latest entrant into the live media. Science can be compressed into a blog and article and transmitted into the hand set. The responses from the users may be Sms-sed to the original site/source. The cell phone doubles up as a internet downloader and use the medium of net as well. Like net , the cell phone medium is an anywhere anytime access/interactive medium

Science Wagons

Science wagons like the ribbon express vigyan ratha are directly reaching the people using satellite link hook-ups, audio, video, DVD aids and slide projections. What is better way than reaching the people with audio-visual aids. The AIDS awareness generating ribbon express, science programmes disseminating mobiles vans with satellite link up, audio and video aids like voice recorders, video recorders and slide projections are all live mediums directly interacting with people. Live cyclone and storm warnings, polio , family planning awareness programmes. The moving experts on these mobile platforms may interact with people educating them and clarifying their doubts

Videogames

The idea of using video games to arrive at the science communication through steps could be another ingenious way of involving the video game players who can be anyone children, young and old. Typically the game may start with a puzzle and followed by alternative routes for arriving at the solution. To encourage active participation, marks and points may be awarded the winners of the game.

Conclusion

Involvement of society in science communication is the ultimate aim of dialogue through mass media. The idea of a dialogue in science communication is to ensure the satisfaction of having participated in the discussion of scientific information. Science communication then achieves involvement of society in it’s two-way journey.

Effective Utilization of Technological Development– Opportunities & Challenges for the Rural Populations

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Abstract. We are living on the era of Global village, where all the development happens in Science & Technology is well known to every citizen through Information Technology. In this context, every one living in the rural areas should get connected to the Information Technology applications; applications depending on their needs and requirements. The citizen should know how to connect, where to connect, when to connect with the available applications etc. for their needs and requirements. By considering all the aspects, this paper proposes to reduce the digital gap using the following aspects to improve their day-to-day life activities effectively for the rural masses. This paper analyses the challenges and proposes a new and novel approach of taking information technology applications to the rural more effectively.

Keywords: Digital gap, Information technology applications in rural areas

Introduction

We are living on the era of Global village, where all the development happens in Science & Technology is well known to every citizen through Information Technology. In this context, every one living in the rural areas should get connected to the Information Technology applications; applications depending on their needs and requirements. The citizen should know how to connect, where to connect, when to connect with the available applications etc. for their needs and requirements. By considering all the aspects, this paper proposes to reduce the digital gap using the following aspects to improve their day-to-day life activities effectively for the rural masses:

- Integrating the NSS / NCC students cadre / Social working Groups of nearby Educational Institutions with the rural villages
- Awareness programme about Sciences & Technology utilization like Space Satellite Applications, Medical Applications, Tele Medicine, etc., in their day- to – day life , which leads to improves Quality of their life .
- Sciences & Technological Centre for every village Municipality for people living in that areas can develop their knowledge about happening across world
- Nurturing & Grooming the school children’s towards the development of Science & Technology to develop future Scientists, Social Scientists , Medical Doctors, Technocrats , etc., to strength our Nation
- More effective way of Using Mobile Technology for Information and Knowledge exchange thro Video’s with experts of their need in Agriculture , Health Care with minimal cost
- Awareness about energy saving programmes

Opportunities and Challenges

The following scenarios’ are faced by the villagers in rural for their day-to-day life in the Indian context

- Lack of awareness in accessing needed/crucial information
- Rural citizens are not able to know their living rights
- Lack of knowledge in development of Sciences , Technology , Health Care , etc.,
- The rural masses should travel for a long distance to the cities / State head quarters for their needs like approvals, licensing, etc., from Government department / officials - which leads to spent their valuable time
- For certain information they don’t know how to approach / where to approach, dealing with departments, etc.,

- Indian youth has an opportunity to connect the entire world through the technological advancements.

Creating Awareness

The rural masses should be developed to the level of Global citizen, were they can lead their self-sufficient life. Rural masses should have the knowledge of all the inventions developed for the mankind applications (equipments, agricultures implements, medicine, etc.,). As a part of social responsibilities, it is our duties to expose the modern technologies applied in villages of developed countries. The awareness should be created in the following areas:

- ***Health care**:* Healthy life awareness camp in food habits (nutrition foods), first aid, Telemedicine, webinars, seminars and hygienic sanitary systems are needed/to be provided. Medical centre with medical store separately or associated with primary health centre of central/state Government which will cater the demand of medical needs. 24 x 7 dedicated medical centre for villagers medical services are also to be provided. This Panchayat Medical Centre (PMC) is to be connected with the large multi-specialty hospital in metropolitan cities as mentioned in Fig 1.

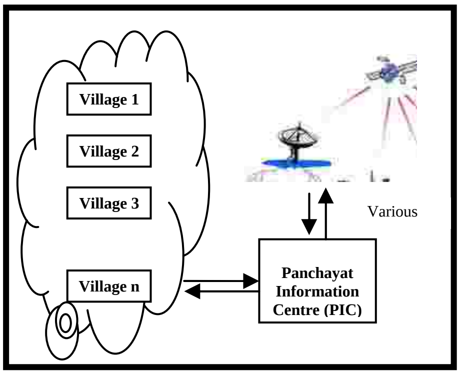

Figure 1: Connecting all villages to Panchayat Information Centre (PIC)

- ***Digital information through information technology**:* Developing information centers in one village or group of villages around five to ten kilometer surroundings is also suggested. The information centre should have Internet connectivity where all the rural masses can get the information at free of cost. Rural masses should avail the facilities like ticket booking, commodities rates, market rates for the vegetables, fruits, etc., The information centre should have facilities like Fax, Printer, Telephone, etc., and it should function 24 x 7 to serve the villagers.

All the villagers should be given ATM / credit card / Debit card for online transaction to book pesticides; any make payment, etc., of their requirements. These online information facilities to be connected to the district head quarters as give in the following Fig 1.

- ***Satellite Communications**:* Information about the wealth of land in particular villages for better crop (seed nurturing) for the season to be maintained. Minerals available in that areas, etc., Disaster Information/alert should be sent to the villagers thro Panchayat Information Centre(PIC) to all mobile phone(if applicable through the regional languages of their choice) of individual people from Government Department as mentioned in Fig 2. This Panchayat Information Centre (PIC) is connected to the Government Departments, other sources of information centers, websites, etc., through the satellites.

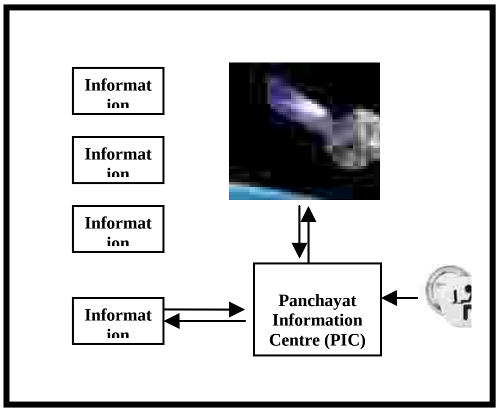

Figure 2: Networking of Information Centre

All the mentioned activities will posses the rural masses for their upliftment in their day-to-day life style.

Challenges: Approach for Creating Awareness

a. Integrating various departments

It is recommended to identify and involve the following potential groups for the collective growth of a village or group of villages involved in a panchayat.

- Departments

- Associations
- Non Governmental Organization (NGO)
- Self Help Groups (SHG)
- Educational Institutions
- Corporate

b. Roles and responsibilities

The roles and responsibilities of each participant can be given as follows;

Department**:** Primary health department can be assigned for health related treatment co-ordination for the villages, record of the health of each villager, etc.,

Associations**:** The industries association such as CII etc., for the district can be involved for purchase of equipments, etc.,

Non-Governmental Organization (NGO)**:** The overall co-ordination of the NGO's specialized activities like (palm tree, environment, and education) can be given primary importance.

Self-Help Group (SHG)**:** Involving SHGs like incharge of the information centre, maintaining records of each villagers, supporting the hygienic and healthy awareness programmes ,etc.,

Educational Institutions**:** NCC / NSS units of the educational institutions can be involved for creating awareness through camps , road shows, skit , medical shows , technology shows , etc., for Sciences & Technological awareness and happening around through mobile van, etc., Also they can arrange some camps for blood testing, eye testing, medical check-up camps.

Corporate**:** The major corporates can be involved by their assistance/sponsorship through technological resources which can be exempted from Income Tax.

Utilization of Technological Development–Execution of The Programmes

All the associated individuals, associations, NGOs, SHGs, NCC/ NSS of Schools and Colleges should deliver their responsibilities for the upliftment of the villagers.

Training Programmes/Workshops for the villagers for a week in the areas of

- Importance of nutrition/healthy/balanced food
- Providing purified water
- Good living conditions
- Making computer literate to apply in information centre
- Establishing Internet Browsing centers to get information across the world
- Providing need based agricultural related training
- Science and Technology Applications-serving mankind in everyday life
- Environment related activities - more tree planting through waste water/drainage water
- First Aid
- Energy saving programme like solar equipment ,etc.,
- Online certificate courses/training courses

Involving the Villagers for more action oriented towards applying Science & Technology of day-to-day life

Training the trainers programme for staff members, students in schools and colleges depending on their roles and responsibilities.

Every year the villagers can celebrate their 'Villagers Day' or 'Panchayat Day' by inviting all the Administrative Government officers, Ministers, Eminent personalities of that nativity village which will provide a platform to share their views and also they can improve upon the present scenario.

The following will be the outcome of the effective utilization of technological development–awareness campaign:

i. Individual villagers, level of self confidence will be raised
ii. They will be self starts to do the things better
iii. The programme will drive the individual's to more productive and action oriented
iv. More awareness about life through Science & Technology
v. Knowledge sharing among villagers through this programme
vi. By utilizing the Information technology in the digital era the villagers will get the information of their need related to agricultural implements, pricing of the cultivated vegetables, Medical services, education, internet banking , etc.,
vii. The villagers can able to save more time also they will be more productive

viii. Every Individual will be proud to celebrate 'Villagers Day' or 'Panchayat Day' for the better quality of life
ix. Awareness about best practices adopted across the world

Similar programmes can be conducted every year continuously, so that the development in Science and Technology will be upgraded continuously among the individuals. The Government can also think about dismantling the Integrated departments, the roles and responsibilities can be interchanged for betterment of knowledge sharing.

Conclusion

This paper provided various measures and guidelines that can be implemented for the effective usage of technological advancements in India. The technology gap prevails among the previous generation will be reduced and the Government can drastically introduce new policies and guidelines for the technological advancement. At the end, the gap between the World and the Indian Villages in this digital era of information technology is almost bridged to the Global living standards within next decade.

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Workshop Science, Politics and the Media: an Initiative to Trigger Science in the Public Agenda

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Abstract. In the last decades, European countries realized there is a need to develop public dialogue of science not only to promote scientific culture but also to promote scientifically informed political decisions. However, the echoes of European-wide initiatives have been difficult to be heard at a national level and communication channels between scientists, politicians and journalists remain poorly established. In Portugal, a hallmark in the promotion of a scientific culture was the creation of a national agency. In addition, research institutions are starting to consider science communication strategies to engage the public with their science and their scientists. In order to discuss the role of science in the Portuguese public and political agenda, a workshop was held in April 2010. The workshop involved leading researchers, journalists, and politicians and resulted in a series of proposals and further initiatives to promote the channels of communication between these communities, such as an audience at the Portuguese Parliament and publication of opinion articles in the press.

Keywords: National level initiative, Science in the public agenda

Introduction

The European Union has been keen to implement coherent strategies for the promotion of a knowledge based society, where science has a determinant role. Despite the accomplishments of the last two decades, regular reports highlight the need to further promote public dialogue in science, as well as to develop scientifically-based decision making in global issues [1-5]. Thus, Europe has been investing in global initiatives in order to create a network of practitioners and stakeholders who shall bridge the gap between science and society at a European level (e.g. The European Union Framework Program 7 package in Science in Society). In addition, there are still significant discrepancies at national level regarding public dialogue in science.

In Portugal, an innovative initiative from the Ministry of Science and Technology has marked the last decade: the creation of *Ciência Viva Agency*, the national agency for the promotion of scientific and technological culture among the Portuguese population, which has been having a determinant role in the engagement of the young generations and the general public with science [6,7]. Similarly, research institutions have realized the need to come out of the social isolation they have devoted themselves historically.

In order to discuss the state of the art of the presence of science in the public agenda at a national and European level, a workshop was held in April 2010, in Lisbon, Portugal, under the title: *Science, politics and the media*.

The workshop was organized by members of the scientific Portuguese community and gathered together leading researchers, journalists, politicians and science communicators in an open-ended public debate. The organizers aimed a two-fold intention regarding the role of science in the public and political agendas: to promote a joint reflection of Portuguese researchers, politicians and journalists on the existing channels of communication between each other in Portugal; and to transform the discussion generated into feasible outputs to increase the interaction between these three professional communities.

The Initiative

Workshop design

The workshop was divided in three main sessions, each one dedicating specifically to the:

(1) Relationship between the scientific community and the media, including the presence of science in the Portuguese media (Session 1)

(2) Relationship between scientists and politics, including the role of scientists and the media in political decision making (Session 2)

(3) Purpose and role of researchers and non researchers when communicating science (Session 3).

A panel of speakers representing the three communities was invited to kick off the discussion of each session, paving the way for discussion with the audience. Each speaker was asked to state specifically three positive aspects, three problematic issues and three possible solutions regarding the topic of the session in a 5 minutes intervention. After this initial intervention, the debate was opened to the audience.

The main points of each session were registered by a *rapportteur* whose responsibility was to convey and summarize the ideas discussed and present them at the workshop's closing session and in a post-workshop report.

The primarily target audiences of the workshop were the Portuguese scientific community, the media community and the political community, as the aim was to promote engagement and discussion between these three communities. Nevertheless, the workshop was open for the general public and disseminated accordingly.

A special session was organized at the Portuguese Parliament, as a result from the preparatory meeting with the deputy president of the Portuguese Parliamentary Commission for Education and Science.

Preparation meetings and dissemination

The organizers promoted a series of preparation meetings with the invited speakers, which took place during the months preceding the workshop. These meetings intended at promoting pre-workshop brainstorming discussions with the invited speakers and at engaging them with the event.

Prior to the workshop, an extensive dissemination campaign was launched to assure that the event would have a mixed audience, including researchers, journalists, editors, decision makers and politicians. This included dissemination by email to university / research institutes, social networks, advertisement in websites related to science, media, or politics; media partners; and personal contacts to key personalities. In addition, the venue was selected to be credible, public and easily accessible, to ensure a "neutral ground" for discussion.

Achievements

Preparation meetings and dissemination

There were held 13 preparation meetings between the organizers and all the invited speakers individually. The meetings promoted the opportunity for the organizers to update and discuss with speakers the most relevant issues regarding the connections between Science, Politics and Media in Portugal and abroad. This had a positive impact in the organization of the workshop itself as much as in the participation of speakers. Most importantly, preparation meetings were a major contributor for the productiveness of the discussion held at the workshop, having had a direct impact on the appearance of specific, feasible proposals. Preparation meetings allowed, for example, the identification, and subsequent invitation of relevant researchers or decision makers not previously considered by the organizers (to be present in the audience); for the maturation of ideas presented by the speakers at the workshop; and in an invitation for a special session of the workshop to be held at the Portuguese Parliament. In this session, participants met members of the Portuguese parliament, namely from Parliamentary Commission for Education and Science.

A webpage, a blog, *Facebook* and *Twitter* accounts were created prior to the workshop in partnership with associated organizations. These tools allowed raising awareness towards the workshop. By April 2010, 1093 *Facebook* profiles had associated to the workshop profile, in over 500 page visits and over 1000 wall posts, comments and page likes were recorded. On the day of the workshop, 80 tweets were recorded to be related to the event, which was the most commented topic in the Portuguese Twitter community.

Participants

A total of 190 people participated in the workshop, from which 150 were science related professionals such as researchers and science communicators, 32 media professionals and 8 politicians. This distribution was expected, given the topics discussed at of the workshop and the motivations for each professional group. Participants were affiliated to nearly 50 Portuguese different institutions. The majority of science professionals were senior and junior scientists; and science communicators. Media professionals were students and journalists from television, newspapers, and radio from 13 different media corporations and professionals from 5 public relations companies. Politicians included deputies, leaders and collaborators from 6 different institutions such as the Portuguese Parliament, the Portuguese government and other governmental bodies.

The creation of such a mixed audience, albeit predominantly scientifically based, was determinant to promote discussion on the views from the different professional groups. Public events with such mixed audience have not been regularly held in Portugal.

The debate

Science in the Portuguese media**:** The relationship between the scientific community and the media was addressed in the first session of the workshop, but its discussion extended to the other sessions.

The debate was launched by a Portuguese and a British journalist, who were asked to focus in their professional experience at their countries. The relationship between journalists and scientists in Portugal was described as still lacking regular channels of communication. The journalists participating in the debate stressed out their difficulty in finding information about Portuguese science, as well as to have direct contacts of Portuguese scientific institutions and researchers. The recent creation of communication offices at research centers and universities was unanimously seen as a positive step forward. However, it was stressed that the number of research centers investing in these structures is still reduced. Thus, it has been highlighted the need to increase the number of communication offices at research institutions as well as the promotion of trustworthy direct relations between scientist and journalist.

In addition, in her contribution to debate the invited Portuguese journalist focused the many other difficulties that science journalists encounter, namely the incipient development of science journalism in the country.

The origins of science journalism in Portugal can be traced to twenty years ago when a restricted number of journalists and editors promoted the establishment of science sections in specific reference newspapers and other media. However, even though two decades have passed and despite the good quality of the work developed, there is still an extremely reduced number of professionals specifically dedicated to science journalism in Portugal nowadays. It was agreed there are presently only *circa* 20 science journalists actively working in national media covering both the activity of approximately 40,000 scientists in Portugal and science at international level. Moreover, this reduced number of journalists is not expected to grow in the future, given the negative impact of the global economical crisis in media business. On the contrary, the tendency has been towards the reduction of the number of science journalists working for media worldwide by turning them into generalist journalists. This tendency is even more deleterious in Portugal, where there has been an unprecedented burst in science, not only in quantity of scientists but also in quality of the research published in the last twenty years.

As the reversal of this shrinking tendency of science journalism in classical media is not foreseen, the participants debated on whether the initiative of science journalism should be taken up by the research community. In his contribution, another science journalist said that research institutions and universities should assume leading responsibility for science communication, including science journalism. Among the proposed initiatives was the investment in: 1) communication tools that do not imply mediation by journalists such as science blogs; 2) collaborative sites for science communication; 3) “niche” sites, as already happens in the U.K. and U.S.A. (e.g. http://www.futurity.org/).

On the other hand, the British journalist highlighted what has positively changed regarding science in the UK media in the last 20 years. She referred the positive changes in researchers’ attitudes, which started to participate more actively with the media and appear now as interesting and entertaining people, as well as the strong increase in science dissemination initiatives such as festivals. Most interestingly, she refers to the disappearance of science sections in the UK media as a positive indicator of the move of science from a specific issue to become transversal to many media sections. Moreover, she highlighted the importance of science journalism in the increased participation of science in policy making and in public participation.

During the session, it was also discussed that there is still a long way to successfully promote scientific literacy of the Portuguese population. Scientific literacy was considered essential for the establishment of a true public dialogue in science-related issues. Scientists already know they have an important role in this process, but they do not know how to do it.

Most importantly, it was identified a need to work in the communication of risk and in the communication during crisis in Portugal. The existing lack of expertise to communicate risk was interpreted to result from a lack of transversal trustworthy science-based organizations, such as the Royal Society and the National Academy of Sciences in the UK, to effectively communicate risk and lobby for science in the public agenda. One proposal was that regular channels of communication should be promoted by the scientific community, so that when a crisis appears, the communication is facilitated.

It was debated that Portuguese scientists and science journalists can learn from British initiatives, namely in ways for the scientific community to have an active role in controversial issues related to science. This proactive attitude can promote a representative lobby for science views in the media. Specific examples that occurred in the UK were discussed, including the controversy on *in vitro* fertilization treatments and public debate on climate changes.

The role of media in science policy, in particular in funding of science was also discussed. The media can influence the promotion of hot topics in science rather than other scientific areas and this can frame science funding decisions. For example, nowadays life sciences have become an hot topic, attracting a good proportion of funding, whether other basic research areas have been left behind (e.g. plant research); and that this can be detrimental, as “we never now from where the next big discovery will come”.

Channels for scientists and politicians to communicate: The relationship between scientists and politicians was addressed during the second session of the workshop. The panel of invited speakers consisted in representatives from the three communities, namely one deputy from the Parliamentary Committee for Education, the President of the Portuguese science funding agency, a renowned Portuguese science journalist and three senior researchers of which one has already served as Secretary of State.

When launching debate, invited speakers highlighted the idea that science, media and politics are three distinct centers of power that are internally heterogeneous and have radical differences between each other in terms of authoritative criteria, language, values, beliefs, interests and priorities; that each center of power, or community, has a patronizing attitude towards the others, even though not explicit; and that the relationship between each other is ambiguous, albeit increasingly more interactive.

The absence of regular interaction between the three communities in Portugal was recognized indirectly by reference to isolated initiatives of public interaction between science and politics, such as the *café scientifiques* at the parliament occurring once a year (i.e. events that gather scientists and politicians to discuss a scientific topic), and to the absence of reference institutions to represent the scientific community as a whole. Thus, a major challenge has been identified as to decipher how to transform the existing, casual and often externally imposed interactions into a network of organized interactions, governing trends and co-production. In addition, it was pointed out that there are at least other two key players to consider: economic power and civil society.

The participation of science advice in political decisions or in societal issues has been well recognized by the scientific community. However, it was identified a need for this community to better acknowledge that the solutions for any societal issues are not merely scientific, but also political, economical and administrative, among other aspects.

It has also been referred that the scientific community cannot limit its participation to science advice and needs to become involved in multidisciplinary teams working on the implementation of solutions. For example, it has been proposed the creation of joint science-public policy platforms in specific areas involving a network of academia, research partners and governmental and non-governmental bodies - one such platform is being created in the area of social sciences; another proposal referred to the creation of a *think tank* for Portuguese science and public policy, which is currently non-existent.

On the other hand, the excessive hierarchy of political decision in Portugal was identified as a barrier to the participation of science in political decision, as well as the deficient scientific literacy of members of parliament and governmental bodies. To address these barriers, it has been proposed the investment in training and empowerment of the administrative professionals who are often those intrinsically involved in the implementation of public policy strategies. The discrepancies between the “timing of science” and the “timing of political decision” were considered also a relevant barrier to science advice in political decision: when governmental bodies request scientific or technical advice to the scientific community there is seldom a timely response, leading politicians to rely in private consultancy for advice, which is usually based in case-studies from other countries, and thus different contexts.

Regarding science policy, the discussion focused on the challenges for young scientists and how to promote proactive attitudes at the individual level. Participants have discussed whether initiative at individual level, at least for junior scientists, should occur on the level of the research institutions, which could then act to influence political power.

On the participation of the public in science policy, which was recognized to be practically non-existent in Portugal, it was proposed that it could be stimulated with specific initiatives, such as promoting "participative budgets for science". Participative budgets have been implemented at the local level in Portuguese city halls funding and could be exported to science policy. These would imply the civil society to participate in the definition of a specific parcel of the public budget for science, for example, 5-10% of the annual budget.

***Communicating science in Portugal*:** The state of the art of science communication in Portugal was the subject of the last debate session of the workshop. The panel of invited speakers included researchers with experience in communicating science and professionals fully dedicated to it, albeit in different settings, such as science museums and research institutions.

The recent advances in science communication in Portugal were discussed. A special focus was given on the role of the national agency for dissemination of the scientific culture *Ciência Viva* in the engagement of the younger generations (and the general public) in science. The essential role of the 19 *Ciência Viva* science centers (settled across the country) for the establishment of a nationwide network of researchers, school teachers, students and other stakeholders was recognized. Moreover, science centers and museums have been acknowledged as privileged venues for engaging the public with science because of their informal and "neutral" nature.

The role of outreach teams at universities and research centers as coordinators of the initiatives from the institutions was also discussed. Although still in a most reduced number, their existence was consensually seen as essential for the development of channels of communication between science and the public.

However, despite the recognition that there has been "a tremendous advance in science communication in Portugal in the last few years", participants recognized that "triumphalism needs to be cooled down", as there is still lack of critical mass in the field and the majority of researchers are still not committed to public accountability of science.

There were conflicting opinions on the compatibility of a successful science career with dedication to science communication activities. Whereas some participants found that successful scientists should not only perform excellent research but also engage actively in science communication, others considered that these activities hinder progression in the career in several ways. One important barrier for this was that science communication initiatives are not considered in the evaluation of researchers, at least in a clear and sound manner. The role of research institutions in the motivation of scientists was considered crucial, not only because they can create conditions for initiatives to develop, but also because they can act directly on the recognition of these activities for career progression. It was recognized by participants that although at national and international levels there are already incentives for scientists to engage in science communication, these measures are still lacking implementation at the level of evaluation. Thus, it was proposed that evaluation criteria for research projects funding and individual grants should include specifically previous science communication experience as an asset for researchers' evaluation; and that science communication experience should count towards students' evaluation in advanced training, for example, as eligible credits for the *European Credit Transfer and Accumulation System* implemented for higher education across Europe. The promotion of good practice among the scientific community to value participation in science communication has been said to be dependent on positive pressure from the scientific community itself. Also, it was highlighted the need to invest in professionals fully dedicates to science communication both at the policy and institutional levels.

Future Perspectives

In a Europe thriving to become a leading knowledge based economy, today the role of science is crucial, but not sufficient. Scientific knowledge needs to be appropriated by the civil society and become part of its cultural, political and economical outputs [8] . In addition, science-based policies for global issues need to become common practice not only at the level of European but also at a local, national level. Scientists, politicians and the media play determinant roles in these processes. In the workshop *Science, politics and media* the Portuguese scientific, political and media communities discussed existing channels of interactions between them and provided common outputs to promote these interactions.

The debate helped to discuss relevant initiatives and to identify major barriers for interaction. It became clear that there are barriers that hinder the presence of science in the public agenda which will only be overcome by a creative approach from both the media and the scientific community. It became also clear that a major challenge is to transform isolated contacts between the public political power, the media and the scientific community into a network of productive interactions; and it was clear that despite the ever growing awareness on the need to engage with the public, the scientific community needs more commitment and *know how*. To overcome these barriers, specific proposals were discussed such as the creation of a national *think tank* for science-based global issues; the development of public participation in science and the implementation of evaluation procedures that reward researchers for public engagement in science.

The *Science, politics and the media* workshop was in itself a rare opportunity for the three Portuguese communities to interact. Moreover, the event should be envisaged not only as productive debate but also as a starting point for additional actions currently under way, including the publication of opinion articles in specialized media; the production of a state-of-the-art report to be presented to the Portuguese Parliament; and the organization of future workshops. Thus, this workshop appears as a feasible approach to trigger science in the public agenda at the national level.

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The Interrelation between University's Public Relations and Science Communication Education

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Abstract. CoSTEP is an educational organization of science communication at Hokkaido University, Japan. It implements two-way communication activities in science and technology in various areas, including the university and the society. Through such activities, we promote education and research in science communication. CoSTEP students acquire the skills required of science communicators through practices. In our program, from 2009, we have been providing our students with a project class, called "PR media project", in which they plan and produce university's PR magazine. Three teachers and ten students constitute the project team. We make a project proposal, interview researchers and students in the university, write articles, and edit them. The team is demanded from the university's editorial board to interview and write the articles. The board members revise them. We frequently discuss its design and layout with a production company.

The team clarified the readership. We regarded high school students as the main target, and surveyed them. For example, we had questionnaire surveys to high school students and their parents on the open campus days and visited a high school to interview several students and teachers there. Thus, we not only publish articles about researches in the university, but introduce various aspects on the academia which the readers would like to know, and also pay attention to the design. Through the trials, we made more efforts towards producing articles and the whole magazine which were easy to communicate with the readers than the conventional ones. After immediately the publishing, we had a workshop on the magazine. Those who are interested in PR participated in the workshop and the magazine was evaluated by such third persons.

Producing university's PR magazine incorporating science communication is not completed by mere interviewing and writing. It can be expressed by the communication activities involved mainly in five parties: the project team, the editorial board, interviewees, a production company, and readers. CoSTEP has other classes which involve university's PR in terms of alternative media. For example a café project team is constituted by five students, and they plan and organize a science café, where a university professor is invited as a guest and makes a scientific talk followed by casual dialogue with citizens. The talk tends to be an introduction to the professor's research in the university. CoSTEP students also prepare for the posters and fliers about the event, and distribute them widely inside/outside the campus. In this sense, this science café can be said to be a field or media for university's PR.

To sum up, university's PR and science communication education are positively influenced each other. On the one hand, by incorporating some elements of university's PR into science communication education, we can make such education that the students can learn to communicate to the public scientific matters in easily understandable ways through utilizing various media and they can improve their skills for communicating with others or stakeholders in the real society. On the other hand, by incorporating some elements or ideas of science communication, university's PR, which has an inclination to one-way advertisement conventionally, can focus on the target, receive feedback from the readers or participants, and design effective PR by such communication in terms of various media and methods. By practicing such trials, university's PR can evolve into "genuine public relations" which strategically emphasize on interactive communication with the stakeholders.

Mobile Phone Mediated Learning Among the Students of Bharathidasan University: A Study From the Perspective of Science Communication

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Abstract. Since we live in the new digital age, it is imperative that university students are taught life skills for this digital age. The mobile phones had become small, personal computers, providing clock, calendar, games, music player, Bluetooth connection, Internet access, and high-quality camera functions in addition to voice calls and short messaging. The 'smart phones', allow students to read pdf formats, spreadsheets and word-processed files and they are useful, in university education.

The Indian telecommunication industry, with about 584 million mobile phone connections as of March 2010 is the third largest telecommunication network in the world and the second largest in terms of number of wireless connections. The Indian telecom industry is the fastest growing in the world and is projected that India will have a 'billion plus' mobile users by 2015.

A mobile phone or mobile (also called cell phone and hand phone is an electronic device used for mobile telecommunications (mobile telephone, text messaging or data transmission) over a cellular network of specialized base stations known as cell sites.

This paper is specially designed to study the impact of mobile phone on mediated learning science communication among the Bharthidasan University students. It also focuses on the positive use of mobile phone among them. Further it studies how mobile phones become a tool to support curriculum and its personalization.

Community Radio as a Tool for Science Communication: Special References to Holy Cross fm, Trichy

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Abstract. Holy Cross Community Radio was launched on 26th December 2006 as a new initiative of Holy Cross College, Trichy. In the initial phases of establishment, Holy Cross Community Radio was available on 90.4 MHz frequency and the channel had eight hours of transmission (including repeat transmission) a day. It reached in and around ten kilometers of Holy Cross College. The target audience of this radio initiative was the women from Dharmanathapuram and Jeevanagar areas, which are the major slum areas in Trichy.

Community radio is a type of radio service that offers a third model of radio broadcasting beyond commercial and public service. Community stations can serve geographic communities and communities of interest. They broadcast content that is popular to a local/specific audience but which may often be overlooked by commercial or mass-media broadcasters.

Community Radio Stations are operated, owned, and driven by the communities they serve. Community radio is not-for profit and provides a mechanism for facilitating individuals, groups, and communities to tell their own diverse stories, to share experiences, and in a media rich world to become active creators and contributors of media.

In many parts of the world, community radio acts as a vehicle for the community and voluntary sector, civil society, agencies, NGOs & citizens to work in partnership to further community as well as broadcasting aims.

This paper focuses on the how the science reaches the mass through the community radio. This paper also deals with different science programmes bringing various taboos to limelight enhancing people to think rationally.

The Assessment of Science Popularization in China

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Abstract. This paper explores the history of the assessment of science popularization in China for ten years. It analyses the characteristics of the assessment of science popularization by several typical cases. The article considers the assessment has impacted on the development of science popularization and communication in many ways. Moreover, it has influenced many policy-making of science popularization and promoted science popularization and communication in China.

Keywords: Science popularization, Science communication; Assessment of science popularization

Science and Technology Journalism to Enlighten the Society: Efficacy of e-Magazine in Enlightening Children

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Abstract. Magazine reading plays an important role in young people's daily media diet. Although young people report seeking loads of scientific information from e-magazine sources, little is known about the frequency and nature of scientific information in e- magazines targeted to young audiences. Against this backdrop, this paper presents a content analysis of two science e- Magazines. This content analysis explores the presentation and content of two popular science e- magazines for children. Articles were analyzed for definition, concepts, experiments, illustrations, examples, cost effective working model guide for effective understanding, expert opinion on various complicated issues and feedback for the queries and suggestion from the readers. Analyses were also conducted to find the attractiveness and graphics explaining various concepts, readability and viewer ship of the content. Findings demonstrated that magazines contained a variety of science related topics which invited a great deal of comments and discussions in the forums. The scientific magazines taken for analysis were for young children who have started exploring the world of science.

Technological Temperament v/s Scientific Temperament: And Effect on our Environment

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Abstract. Current advancement in devices like computers, laptops, mobile phones etc. has changed the world completely. Today we are trying hard to increase scientific temperament but technical temperament is increasing very fast defeating the scientific approach. Today urban man became the “technology addicted”, he can’t take even a single step without electronic gadgets. This is definitely not showing the scientific attitude of man because excessive use of electronic devices is harming our beautiful Environment. Recent convergence and re-convergence of technology demands more careful and scientific usage. This issue is just not related to our environment but the man’s psychology and health also. Nowadays people are well adapted themselves with advance technology and acquire the technical temper very well. But somehow it’s not beneficial in long terms, because acquiring the technical temperament common man is ignoring the scientific one. In this paper I critically analyze how fast spread technology became a curse for awareness in common man and also go through the necessity of electronic gadgets their usage and its effects on our natural world.

Risk Communication in India: Emerging Perspective

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Abstract. Risk communication is important especially to the public in the form of an attractive and consumable product at times when they need it the most. At the same time, the public involvement and engagement with risk communication practices may offer a multilateral diffusion of such knowledge that empowers people with the ability to take not only informed but also analytical and rational decisions to combat and overcome the risks. Corporate sector has an added social responsibility to achieve this objective. Especially, in the emerging countries like India, a number of corporate houses, national, multinational or international are engaged in a variety of activities ranging from research and development to production and manufacturing causing a plethora of risks with multiple magnitudes. They are expected to educate the public, make the people aware and build the capabilities into them to be able to fight against hunger, drought, diseases, disasters, and superstitions with courage and self-confidence. An account on role of corporate sector in risk communication with reference to developing countries is being given in this paper; i.e. i) Creating public awareness as what a particular corporate firm does; ii) How it is going to benefit or harm the public (for example: Union Carbide Corporation, India did not inform the public about possible Methyl Isocyanate gas leak, that caused thousands of casualties in Bhopal, India on 02 December 1984); iii) Providing informal risk education to the public; iv) Solving local problems causing risks with communication inputs and management interventions; and v) Improving the quality of their public relations and promotional programmes, etc. The paper discovers a range of issues and problems concerning corporate sector and risk communication and identifies certain possible solutions.

Communicating Risk

Risk communication is generally attributed to the interactive process of exchange of information and opinions amongst individuals, groups, and institutions concerning a risk or potential risk to human health or the environment. Risk communication can vary from environmental communication and safety communication to health communication. It can involve care communication (which relates with awareness), consensus communication (which relates with preparedness), and crisis communication (which relates to actually dealing with crisis). Risk communication includes environmental, health, disaster and other issues causing any risk, threat, crisis, conflict or uncertainness to mankind.

For example, over 80% diseases are caused by unpotable drinking water and millions of people are dying every year from petty diseases, such as, diarrhea and jaundice, etc., which are curable, but there are hardly any effort to educate people about the risk involved in taking dirty drinking water. Surprisingly, neither scientist seems to be eager to solve this problem, nor the media shows intention to cover such issues, as perhaps these cannot fetch handsome research grants or make media headlines. As a contrast, if you talk about so called dreaded diseases and high end cutting edged technologies, you are likely to get attention from all around! Dealing with such communication risks seems to be a great challenge. Similarly, sometime unnecessary media hype gives a different perspective. In case of foot and mouth disease outbreak in USA and some other countries, media gave it undue hype, though, as a matter a fact the disease was limited to cattle only and there was no risk for human health.

Social Responsibility of Industry and Corporate Houses

The industry and corporate houses generally use common natural resources like air and water directly or indirectly for running their businesses. Besides their commercial interests, they are responsible for the welfare of the society that includes educating public about the work they are doing. It would help create better understanding between the firm and the society leading to enhanced cooperation and minimizing risks. The industry is not only responsible to educate their employees about possible occupational hazards but also it must shoulder the responsibility to educate and prepare the residents of the locality to be able to cope-up with possible disaster due to any fault in the industry.

Had the Union Carbide, India educated the public about the lethal effects of Methyl Isocyanate (MIC) gas and simple precautions, the life of thousands of people could have been saved. Simple information could have done wonders. A wet towel or any wet cloth can save life if it is put over the mouth and nose in the event of leak of MIC gas. Since MIC gas is soluble in water, it will be absorbed in the wet towel and will help reduce ill effects of the killer gas. Most of the people were became victim of the gas because they ran in the same direction in which gas was flowing. Had they gone in opposite direction, they could have been in a better position. The industry must not escape from its social responsibility, especially when it comes to life and death of the people. It is an advantage, if the people are educated about other related subjects also.

Solving local problems of public importance with communication inputs and management interventions is equally important for the state, public and the industry, as in most cases we find industry at the backdrop of a problem. Often, local scientific or technological risk issues do not find place in mass media. It is worth noting that there has been considerable success in addressing local issues/ problems/ technologies through local/ regional level science journalism involving and motivating industry. An example is noteworthy here. In a workshop on risk communication for media persons at Rampur, India, a group of journalists discovered during the course of preparation of their story as an exercise of on the spot reporting that untreated effluents from Kashipur and nearby industries were being discharged in the Kosi River. Animals died as a result of drinking the polluted water of the river. Even trees and plants did not survive. Moreover, the ingress of polluted river water in the wells of the nearby 60 villages rendered water unpotable. This group of reporters made a thorough investigation of this problem during the course of the workshop. Specimens of polluted water were collected and analyzed. When the reports appeared in media, the authorities and industries were alarmed and forced to take a number of measures to solve the problem. This is how such local level risk reporting can help bring to the fore the local problems and help address the same.

Corporatization of Media and Communicating Risk

Media is considered to be the fourth estate of power especially in a democratic setup, like India. The advent of latest Information Communication Technology has opened new vistas of global or transnational exchange and access of media flooded with ample amount of international news and information lacking sufficient local and regional news coverage. At the same time, there exist countries that are not blessed with the power of democracy and hence may not be able to enjoy the power of fourth estate. In the circumstances, it is not only difficult to get the news but also to access them from outside the country. In case, someone succeeds in getting this censored or cooked-up news through unlawful sources, it leads to the next level of complicacy, as this news may not be authentic. It so happens, especially in case of coalmine collapses or similar disaster takes place. In such cases, the accountability of the source cannot be beyond doubt.

The primary function of media was to inform and educate public about the day-to-day happenings all around but now the primary function of media has become to sell audiences to advertisers. The media does not make money from subscriptions. Any TV News Channel does not make money when you turn on your television; they make money when an advertiser pays them. Now advertisers pay for certain things. They are not going to pay for a feature on risks of environmental degradation or a discussion that encourages people to participate democratically and inculcate a scientific bent of mind and rationalism. Unfortunately, the media houses further encourage the corporatism in a multinational business atmosphere that has a number of emerging commodities and pro-corporate concepts to sell to the audience.

The state of the Internet right now is rather like the state of the electronic media back in the mid 20th century. In most countries, radio or a large part of it was handed over to the public interest. Radio was mostly handed over to big corporations despite struggle by Church and other groups. Later, with television, there was no struggle at all. Now, we have the Internet. Like all the rest of modern technology, the public funds it. Even with print, there was a large, independent press in both England and the USA earlier this century. In England, it was on the scale of the commercial press. They were gradually taken over by corporate power. Even in developing countries like India, big corporate houses that mainly have their commercial objectives generally run the press and media and science, technology, health and environment stories for them is a tailpiece affair.

Risk of Commercial Compulsions

It has been a growing belief that only things having commercial and economic viability will sustain in today's fast advancing world that is governed and influenced by commercial and economic factors. The issue of increasing influence of commerce on scientific research and development and problems arising thereof has been the focus of discussions at various forums recently that causes risk concerns the world over. Things have even reached the point where commercial compulsions are making fundamental changes in the way risk issues are handled, and in the way, it is communicated. A step ahead, the efforts directed towards dealing with risk communication also tend to face the similar challenges and therefore it cannot be seen in isolation.

In a business driven society, if a corporate house is spending a couple of million of currency on public relations, it knows how to package things so as to overcome public opposition and change public attitudes and psyche to be able to sell their concepts and not the concepts important for risk preparedness. It seems to be rather unfair to expect such corporate owned media houses to realize their responsibility towards risk communication. Increased media globalization nowadays is overwhelmed with corporatism that has only objective of income generation, leading to a state of obscurism away from pragmatism.

Investigative Approach

The risk communication is chiefly limited to describing various aspects of a particular risk, either in a descriptive manner or some precautions for it. A number of multinational and foreign companies are opening their research centres in developing world because of availability of comparatively low cost resources and manpower. These corporate research centres range from pharmaceuticals, biotechnology and information technology to agriculture, etc. To bring public awareness about certain risk factors, there is a need for investigative journalism in this field. Whether safety measures have been taken, is there chance of any possible disaster or hazard, how the anticipated research is going to benefit or harm, is there any environmental threat to water bodies, animals or plants, are some of the questions which could form part of investigative reporting. Whatever is happening in this field, good or bad, proper or improper must be brought before the people. This form of communication is attractive in its own way and retains readers' interest in the article to read further. Normally, a journalist publishes an article after a thorough investigation on political, social, or an economic issue. This aspect, however, is largely absent in the case of scientific, health and environmental topics.

The various forms of risk communication become clear only when aspects like proper or improper uses of science and technology and good or bad impact of the same on society are brought to the fore. Risk reporting then will develop into a form of an alert guard and adviser, say, the case of introduction of new technology, genetically modified food, CNG fuel, and so on. It is necessary to realize that investigative journalism does not imply investigation of any irregularity alone or projecting something sensational, but brining to the people those useful information also still not known far and wide.

Emerging Concerns

The concerns have been expressed from across the country on different occasions on different risk issues and aspects. For example, a multinational organization was involved in a research project on *Aides egypti,* which causes a yellow fever, but not in India. On investigating the relevance of this research, it came to fore that the company had some hidden objectives. The worldwide scoop was published in the media and the project was closed as a result. Similarly, here is an interesting case as how the world came to know the nuclear programme of a country! There were consecutive global tenders for a device used in nuclear operations, a system that keeps the critical mass separate, and a catalytic converter after an interval of some period. A vigilant journalist was able to connect the link of these tenders and found the truth and reported in media.

There could be some very strange risks associated with the social systems and traditions. In India, in Maharashtra state, people objected to installation of wind mill farms with a mis-belief that if wind mill will extract the oxygen from air while producing electricity, how they will breathe! Similarly, according to a scientist in a neighbouring country, a parliamentarian has made a proposal to the government to capture the evil spirits and put them to work, thereby solving country's energy problem. A number of risk issues are emerging out of unlawful practices of food adulteration, cases of spurious liquor, over claims by advertisements of consumer goods, insufficient trials by pharmacy companies, and genetically modified foods, etc. The public needs to be made aware of the risks involved in such activities.

Conclusion

As the 'information age' rapidly progresses and if we want to direct it towards 'knowledge age', we need to develop the potential at foundation level to foster and support appropriate synergistic and imaginative combinations of disciplines. Improving quality of public relations and promotional programmes of risk oriented organizations is yet another area of great concern and needs to be addressed. Most corporate houses have PR and Promotional departments; generally, their main task is image building of the organization and propaganda to sale its products. These departments can be augmented and oriented in a way to be able to communicate risks to the public including their activities and scientific aspects of their services and products. It has been observed that the press releases and hand outs issued by these groups are generally not up to the mark or media friendly. Risk communication should be looked as the collective responsibility of scientists, communicators, states, social activists and workers, etc., and cannot be pursued in isolation.

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Europlanet Nodes–Promoting Planetary Science Across European Borders

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Abstract. The Europlanet Research Infrastructure links more than 100 teams working in planetary science, in Europe and around the world. The project aims to develop synergies with the ultimate goal of a better knowledge of our Solar System. It is co-funded by the European Union under the Seventh Framework Programme. Europlanet's outreach programme aims to build channels of communication between the planetary science community and the public, the media and stakeholder groups such as politicians and industrial partners. Outreach activities are based around a network of national nodes that share experiences, spread news and promote planetary sciences at a local, regional, national and European level.

BCDI–Communicating Bamboo Science and Technologies

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Abstract. The bamboo and cane crafts occupies important role in the economy of North East Region and is also one of the largest employment provider in the region. The demand for these eco friendly crafts is huge both in the domestic as well as in the international markets. However despite huge production base the products are not sold well due to lack of technology and product development as per the growing consumer preference. Development Commissioner (Handicrafts), Ministry of Textiles, Govt. of India with an objective to fill up the gap in the area of Design and Product Development initiated setting up of Bamboo and Cane Development Institute (BCDI) in 1974. National Centre for Design and Product Development (NCDPD) has been entrusted with the responsibility of running and management of BCDI by O/o. Development Commissioner (Handicrafts) with an objective to professionalize the efforts in an effective manner. NCDPD is all set to run BCDI in a professional manner with an objective to project BCDI as a centre of excellence for Cane and Bamboo. The Technology Centre and Training is being initiated on priority. The centre seeks improvement in the competitiveness by upgrading the technology of production targeted to bamboo and cane manufacturers. Creating and promoting sustainable supply chain management and project India as one of the lead suppliers of eco friendly and greener crafts. Following are the current activities for technology dissemination:

Capacity/Skill development programme: is initiated with an objective to educate and upgrade the knowledge of artisans/craftpersons/entrepreneurs of bamboo handicrafts. A well structured course curriculum is structured where the participants get aware regarding technology, design, product development and marketing.

Integrated Design and Technical Development Project on Bamboo and Cane: The main objectives are to provide new and innovative designs and improve the technical skills of the artisans thereby produce market acceptable products. Beneficiaries of this workshop are the artisans/craftsmen engaged in Bamboo and Cane crafts.

Bamboo Technology Centre: A state of the art technology centre is being set up at BCDI, Agartala to provide the necessary technical information and practical hands on training to the Artisans and craftspersons engaged in the Cane and Bamboo Sector. This centre will also facilitate industry oriented training programme.

Bambusetum: facilitates for educating the artisans, visitors and students regarding different bamboos, their characters, properties and identification etc.

In house publication: 'The Enquirer' quarterly news letter for information regarding technology, design and product development. 'Design Excellence 2010' is a compilation of various designs for cane and bamboo product lines. "Know Your Bamboo" a simple book in three languages i.e. English, Hindi and Bengali. It contains information regarding bamboo diversity, propagation, management, seasoning and methods of treatments.

Associations: with INBAR for transfer of technology, training, global market linkages and other areas. BCDI and Tripura University (A central university) signed a MoU for one year PG Diploma on Bamboo cultivation and resource utilization.

Keywords: Handicrafts, Technology, Training and education

A Wireless Sensor Network Simulator: Wish

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Abstract. In many cases it is impractical to experiment on real wireless sensor network systems; there are several reasons for this. First, a proposed hardware platform, while theoretically possible, may not be manufactured. An example of this is a low power system-on-chip hardware platform that, while possible, is not yet practical to manufacture due to up-front design, mask, and fabrication costs. Second, even if the hardware platform exists, it may be prohibitively expensive. Hence simulators are built , many of these simulators are designed for other types of networks; for instance, wired TCP/IP networks. Others, though wireless, are made to simulate WLAN networks and 802.11 protocols, and are also inherently IP networks. Also, some simulators that are designed specifically for sensor networks are limited to a specific programming environment. We introduce Wish ; a wireless sensor network simulator designed to address these problems. Wish is built from the ground up to simulate sensor networks. Wish is efficient; it scales to simulate networks with thousands of nodes faster than real-time on a typical desktop computer. Wish is component based and easily reconfigurable to adapt to different: levels of simulation detail and accuracy; communication media; sensors and actuators; environmental conditions; protocols; and applications.

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Keywords: Qualnet, Simulater, Sensor

Role of Hands-on activities in Science Communication

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Abstract. Science and Technology are the two basic components of developments of a country. Common people can learn about the advancement of science and technology with the help of mass media. A science communicator connects the common people and the scientists by acting like a bridge. The main function of science communication is to exchange information between an informer and a receiver.

To make science communication interesting and informative, it should be activity based hands-on demonstrations. In this paper the author presents his experiences of such type of communication as he is engaged in two projects simultaneously namely Teachers' Orientation Programmes as well as Interactive Science Workshops for the middle school students.

Keywords: Hands-on, Scientoons

Introduction

Science education now-a-days looks uninteresting and sometimes boring. Students are interested for more lucrative career options other than pure science. But no country can progress without the development of science. So we have to be more serious about the way of presentation of the concepts of scientific principle. One way of effective science communication is the hands-on demonstrations. It is difficult to surpass the learning impact of the combination of hearing, seeing and doing.

According to the renowned science communicator, Dr. Manoj Patairiya, digital media now-a-days plays tremendous possibilities for science and technology communication among various target groups (Patairiya, 2000). Although Professor Yash Pal, the famous National Professor, information technology and digital technology are not knowledge creators but knowledge workers (Patairiya, 2009).

Again Scientoons are a new type of methods of effective science communication by using cartoons based on scientific theories (Ray and Dutta,2009). Science outreach programme is one of the fruitful approaches for science communication (Jana, A.K. 2010).

Hands-on Demonstrations

Experiment No. 1: Action and reaction.

When a balloon is attached in the string with a straw, it will move in the opposite direction to that of the direction of the air flow from the balloon. But when a post card is attached on the same straw with the balloon, there is no movement of the balloon as the action and reaction acting on the same body.

Experiment No. 2: Simultaneous decrement of pressure with the increase of speed.

An inflated balloon is placed in each of the thermocole glasses, one having a few windows and the other with no window. A straw is introduced through a hole at the bottom of the glass. When air is blown through the straws, the speed of air inside the glass is increased creating low pressure. The air with higher pressure from outside press the balloon on the mouth of the glass without window. But in the case of windows the air rushes in the glass through the windows and makes the balloon fly. This is a nice demonstration of Bernoulli's principle.

Experiment No. 3: Effect of atmospheric pressure.

The experiment of the rise of water level in the inverted glass which covers a burning candle placed in water is a very common demo used by many teachers to show that 21% of the air is oxygen. But using unequal number of candles it can be shown that the rise of water has no relation with the oxygen content in air. More the number of candles more is the rise of water.

The reasons are:

(i) The pressure of hot air is high and some air escapes and hence the rise of water due to this loss.

(ii) At higher temperature the saturation vapor pressure of water is also high. When the candle goes off and the temperature falls, saturation vapor pressure also decreases and hence the water rises.

Experiment No.4: Electromagnetic Induction.

When a magnet is falling through a vertical conducting tube with poles along the vertical, a changing magnetic field is produced.

This field drives an electric current in the circumferential direction along the length of the tube. The magnet thus experiences an upward damping force and takes an extraordinarily long time to fall through the tube due to electromagnetic damping.

Conclusions

Being a resource person of a few projects of teachers' as well as students' orientation programs since 2005, my experiences confirm that students are observant and curious-they love to explore the world around them. Their scientific skills can be improved by teaching them the scientific concepts of the relevant scientific principle with activity based hands-on experiments (Jana, A.K. 2010). According to Kala (2009), 'Hands-on science activities have some advantages over other communicators, as the great compromise of literacy and knowledge label is only possible here.

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Role of Hands-on Activities in Science Communication

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Public Engagement with Nanotechnology: Initiatives, Strategies and Challenges

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Abstract. Public engagement with science and technology (S&T) has assumed significance in recent years particularly in the context of emerging technologies. Public engagement implies that the public, as non-experts, are an integral part of all deliberations on policy, regulation and governance of S&T. Increasing scholarly attention in science and technology studies (STS) is given to public engagement in nanotechnology (NT), arising at the intersection between science and society in both developed and developing countries. This paper discusses the role and importance of public engagement in NT; attempts to map the various initiatives as well as strategies for NT governance and identifies various challenges to be addressed for its responsible development.

Keywords: Emerging Technologies, Nanotechnology, Public Engagement, STS

Introduction

Engagement in common parlance is used to mean involvement. Public engagement has become an umbrella term covering public consultation, public discourse and public involvement. Public engagement with S&T can be attributed to a tendency towards increased democratization of science. It can also be seen as a reaction to technology development policies that are seen as contributing factors to unacceptable technologies. Whatever the reason, stakeholders–government, business groups, scientists, citizen and interest groups–are currently arguing for the radically new technologies like nanotechnology (NT). NT is currently referred to as leading, innovative research field. Besides revolutionizing a range of scientific and technological areas, R&D in NT promises to have favorable environmental impacts, on the one hand and on the other, adverse health implications of particles at the nanoscale level are compared to those of asbestos (Poland et al., 2008). The most prominent are the messages that portray nanotechnology as “the asbestos of tomorrow” (Scheufele, 2006).

This paper intends to answer questions such as: What activities are contemplated under the label of public engagement? How public engagement is ensconced in science and technology studies (STS)? Why is it important? It then outlines the need for public engagement with NT and examines how dialogues, initiatives and resources in NT have been utilized in various countries to engage the public. To do this, a review of the existing literature and policy documents was undertaken. An attempt is made to map the various public engagement initiatives worldwide in terms of degree of spontaneity and intensity of engagement by adopting the theoretical framework originally developed by Bucchi and Neresini (2008). We also consider the perspectives from institutions and organizations collected during field-surveys on NT in India. Finally, the paper addresses various challenges for engaging the public with NT.

Science, technology and public engagement

What are public engagements? According to Nanotechnology Engagement Group (Gavelin, et. al., 2007: 9), public engagements are “all the different ways in which institutions interact with the general public outside of formal democratic structures such as elections”. In this definition, institutions include members of what we call the NT establishments (government, scientists, technologists, academic researchers and policy-makers). Public engagement with science and technology (PEST) has become an important new dimension as well as a specialized area of investigation within STS. It springs from a report, *The Public Understanding of Science*, which was published by the Royal Society in 1985. This report provided how scientists learn to communicate to non-scientists later known as the ‘deficit model’ of science communication. Here the public is assumed as ignorant and needs to be educated by scientists with the aid of the state. It legitimates further public expenditure on science through popularization programmes and pays no heed to the public response. In fact, science could be problematic for society if the latter is ignored.

Today the debate has gone beyond the ‘deficit model’ in science communication studies. An attempt in the deficit model arose when government scientists in 1986 tried to protect consumers from sheep contaminated by the Chernobyl disaster. But a classic study in this regard by Wynne (1989) showed that scientists didn’t pay attention to other available knowledge when making claims in the Chernobyl case. Because scientists did not consult with farmers on how to best monitor grazing habits and take samples from the sheep, leading farmers to directly witness the messiness of scientists’ sampling methods. The scientists’ ignorance, lack of interest in local realities, and imposition of false assumption about the agency of local people ended up in a loss of trust among the farmers and the consecutive failure of scientific experiments and predictions.

Wynne’s study suggested a new perspective of engagement of the public with science and later known as the ‘public engagement’ model. In the deficit model, the public distrusts science because it is ignorant, but in ‘public engagement model’ the public distrusts science because it has good reason to. The latter model established the agency of the public and demanded scientists to be more reflexive in science. This model has been widely accepted now as participation by public in dialogues or engaging with science and expertise without agency is impossible. In case of a technology like NT there is a need to increase awareness, involve stakeholders like trade unions in dialogues about occupational health issues, address concerns of consumers about product safety, discuss with environmental groups about the environmental impact of nanoparticles and nano-products and instill confidence about the regulatory regime.

What makes new technologies like NT worthy of being engaged? According to Toumey (2006), NT and public engagement have come to the fore at the same time “is a historical coincidence, not a scientific result”. In the 1990s, it emerged into public knowledge that genetically modified organisms (GMOs) had been added to the human food chain without public consultation (Gavelin, et. al., 2007: 2). In 2003, the British government began the GM debate and reviewed the science and the costs-benefits of GMOs? It consulted widely with citizens about why they opposed GMOs. Unfortunately, towards the end of the 1990s, as consumer anger was reaching a peak, civil society had convened conferences, and these were organized long after large companies had invested heavily and brought products to market. The government initiative was seen as “too late” (Ibid: 4). It is reported that the government’s desire to appear ‘precautionary’ led to a reactionary ban of GMOs, and public consultations that favoured environmental lobbies.

The public biotechnology (BT) debate has been pervasive in shaping S&T discussion in the field of NT (Gaskell et. al. 2005). The two fields show intrinsic similarities, not on material level but regarding their scientific, commercial, and governmental framing, and the actors involved in science communication. Experts in science, social science, civil society organizations, and technology assessment (TA) offices who had worked in public relations in biotechnology often became involved in the field of NT (Barben et. al. 2008). Thus, public engagement in the field of NT was from its beginning shaped by three factors: (i) the idea that science communication should have “learned lessons” from earlier S&T related controversies such as agricultural biotechnology; (ii) the idea that science communication in the notion of Public Understanding of Science (PUS) was “ill-defined” and not the right way to create public acceptance’ (iii) the claim for a broader involvement of the public in decision-making of S&T issues, in the notion of open democratic governance.

Public Engagement in Nanotechnology

Why do we look at what kinds of engagement have been undertaken? One reason is to illustrate how the shift from downstream to upstream and from one-way to two-way engagement is still going on. Primarily, we give a sense of what it is that we are discussing when we talk about public engagements. To understand these engagements, we have used the adapted version of the framework, originally developed by Bucchi and Neresini (2008), to map public participation in NT. In Figure 1, the X-axis denotes the level of public engagement in knowledge construction process. It is characterized by two extremes in the continuum ranging from low to high level of engagement. The Y-axis denotes the continuum of extent of public participation elicited by a sponsor to the spontaneity. In this diagram, a wide variety of forms and cases of public engagement exercises in NT can be mapped.

The upper left quadrant comprises forms typically elicited by a sponsor and characterized by low-intensity participation of the non-experts in the knowledge production of NT e.g. the public opinion surveys, citizen's conferences and citizen consultation exercises.

Public Opinion Surveys: This method of engagement has been the Danish and Spanish Board of Technology's response to NT engagement so far. Their surveys or interviews meetings involve a questionnaire to ensure that all thirty participants have a chance to be heard, and the group interviews provides some context for why people believe the things that they do about a given technology. This allows organizers to ask the questions that they think are important. These events take three hours of a weeknight and participants are sent material beforehand to get them acquainted with the subject. Participants are selected based on getting a range of representation, and on a lack of prior knowledge of the technology in question. The topics that are typically considered are complex, new and have an ethical component to them. The results of these interviews are published in a report and made available to policy-makers. Danish NT survey showed an overview of what those citizens found to be important. It found that citizens are excited about the possibilities of NT having a feeling that Denmark should take an active role in the development of NT. However, the interviewees urged for the technology to be developed for socially beneficial ends, and actively opposed developing the technology just to improve consumer goods and enhance human biology. Similarly, public opinion surveys were conducted in Spain for a project 'Dialogue on Nanoscience and Nanotechnologies' and disproved the stereotypes that public has little interest in S&T issues.

Citizen Conference: The most common form of engagement exercise is the citizen conference. It is being used in France, England and Switzerland. For example, Nanomonde and Nanoviv in France helped in generating public awareness and identify potential problems and solutions related to the development of NT. Nanoviv, a series of "public debates" organized in Grenoble by Vivagora, an association led by a small group of former science journalists. The objectives of Nanoviv are the 'identification of the actors and stakes', and 'formulation of recommendations for policy-makers'. These events normally last between one evening and few days. Participants are recruited through advertisements in a regional paper, or at universities. After expert presentations, participants from groups and discuss their viewpoints and have questions answered, before a plenary session summarizes the conversations. These events center on a particular issue or scenario.

The lower left quadrant in the diagram is characterized by spontaneous mobilizations through protest group. Protest groups use non-institutional means of communication e.g. Topless Humans Organized for Natural Genetics (T.H.O.N.G.) has protested in front of an Eddie Bauer clothing store in Chicago over the issue of health problems that could result from using coatings of NT in textile industry for manufacturing clothing. However, such actions have a little impact on influencing the dynamics of research because they lack argumentation, mission statement and list of members.

The lower-right quadrant includes spontaneous participatory forms of knowledge production through non-government organizations (NGOs)/Not-for-Profit Organizations (NPOs) without a deliberate sponsor.

NGOs/NPOs: They promote their positions through research, consultancy and lobbying. In the NT debate, these groups include ETC, Greenpeace, the Loka Institute. For example, the Action Group on Erosion, Technology and Concentration (ETC) Group is the organization calling for a halt to NT research and distribution until the sociological and safety issues are more thoroughly addressed. Interestingly, though the group has been consistent in their call for a moratorium, this is not the group's primary concern. Their primary recommendation is "that

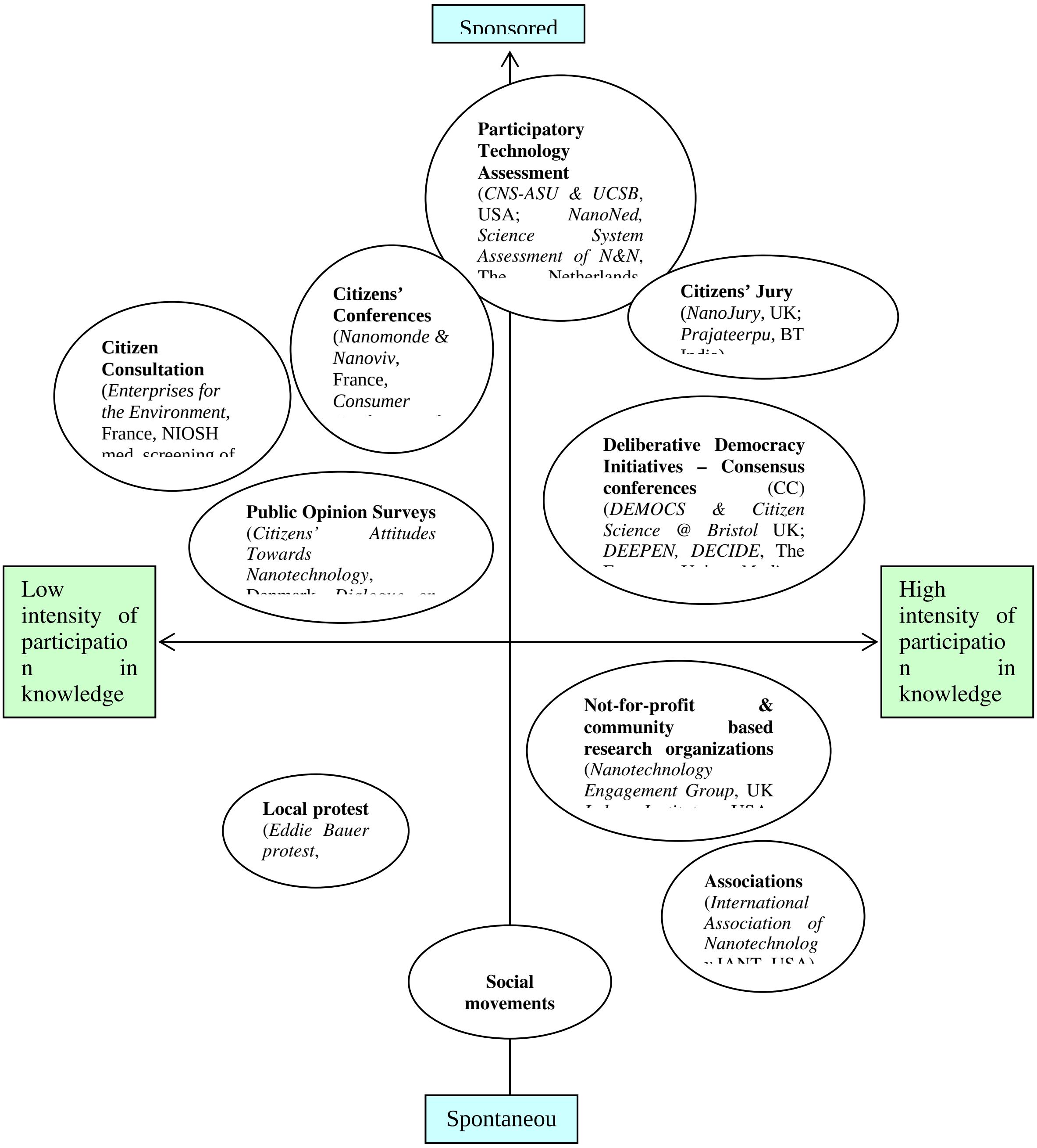

Figure 1. Framework for public engagement in Nano science and technology research Source: Adapted from Bucchi and Neresini, (2008)

society become fully engaged in a wide discussion of the role of converging (nanoscale) technologies" (ETC Group 2004: 53). This includes involving marginalized people, who the group holds in focus through their critique of this technology.

The upper-right quadrant is characterized by high degree of elicitation and high intensity of participation by a sponsoring institution such as consensus conferences, citizen jury, and deliberative forums.

Consensus Conference: It is being used in University Communities of Wisconsin and North Carolina, USA. This involves two preliminary, weekend-long meetings wherein a group, made up of fifteen to twenty lay-people from a variety of backgrounds, is introduced to the technology in question. They decide what issues are most important, debate those issues, and develop questions that they put to invited experts from the sciences and humanities, businesses and NGOs. A consensus conference topic should be "topical, not too abstract, contain conflict, call for clarification of objectives and attitudes, depend on expert contribution for clarification, necessary knowledge and expertise are available" (Grundahl, 1995: 2). Recent topics of consensus conferences in Denmark have included social topics (technological marginalization), environmental concerns (renewable construction), and topics that are of interest mainly to those in scientific fields (research grant size, information technology management).

The actual consensus conference occurs on a third weekend, and is open to the general public. Here the initial questions are answered, more questions are asked and the experts respond again. Finally, the citizen panel produces a consensus document based on the opinions of the participants. The involvement of the lay panel is stretched over three months. Consensus conferences support both quality and responsibility. By giving participants lots of time to consider evidence provided by several experts they can come to well-reasoned judgements, which will lead to better conclusions. They pass these conclusions on to those that attend the final conference and read their report. Furthermore, in Denmark these events sporadically garner wider public attention, leading to a lively public conversation, which reinforces both the feeling of responsibility that people have, and their ability to judge what options will lead to high quality.

Citizen Jury: The most intensive form of public engagement has, so far, been the citizen jury. NanoJury, a citizens' jury on nanotechnologies in UK organized by the Cambridge University Nanoscience Centre, Greenpeace UK, the Guardian, and the Policy, Ethics and Life Sciences Research Centre (PEALS) Newcastle University and used the method of "two-way citizens' jury." The UK Nanojury used a group of twenty-five randomly selected people and met every weekend for six weeks. To persuade people to give up so much of their time, they held another citizen jury before the nanotechnology jury based on a topic, youth crime that the participants chose themselves. The plan was for this group to have more control over what was brought up, being able to call the experts, or 'witnesses', that they felt were important. In general, jurors found the witnesses to be either pro or con, resulting in a more confrontational event than the one on youth crime. At the end of this process, the 'verdict' of recommendations was presented to regulators.

The few unanimous recommendations concerned continuing public engagements, labeling NT products clearly, and making funding transparent and tied to socially responsible projects. Consequently, the jurors wrote recommendations for nanotechnology's future development in the UK and received a promise from the Department for Business, Enterprise and Regulatory Reform of a response. The framing of the public as "citizens" and "jurors" and scientists as "witness" or "audience" reversed the traditional roles and thus supported the idea of mutual learning and two-way communication.

***Deliberative Forums*:** It involves citizens, stakeholders, experts and decision-makers, for an in-depth understanding of socio-ethical challenges and implications posed by NT. For example, Deepening Ethical Engagement in Emerging Nanotechnologies (DEEPEN) of the European Union.

As part of the IDRC supported project on "Capabilities, governance and nanotechnology developments: a focus on India", The Energy and Resources Institute (TERI), a premier think-tank in India, carried out a field-survey for a period of two and a half month. The survey showed that scientists agreed for the communication and public engagement with NT as essential to avoid unexpected or unintended negative consequences. Since NT has been perceived as a much-hyped technology during the survey scientists remarked that "hype-generation is dependent on media due to the accessibility of various media to the scientists". A bio-medical scientist at a leading technological institute for research and education said that "awareness is good thing, hype is not, and paranoia is not. Rather there should be correct awareness". NT awareness can be done through campaign, public forums, exhibitions (e.g. where they showcase NT products, the potential applications of nano-medicine etc.), and seminars regarding its various features such as cost-effectiveness, user-friendliness, eco-friendliness and efficiency. Scientists agree that if there were greater public awareness of NT then there could be more support towards it. NT community should come forward and publicize more materials in this regard and finally the government should advertise ongoing NT research in that country.

Challenges and the way forward

The biggest challenge for public engagement in NT would be first of all to ascertain what do we collectively (aspire to) mean by public(s) and thereupon to ensure a wider representation of 'publics' during the process. Given the fact that the nature of technology is so complex with even scientific community finding it difficult to comprehend, there could be a possibility of engagement from only highly informed groups that are not truly representative and may not reflect the views of widely segregated and differentially capable 'publics'. Further who can speak for publics? NGOs and other "voices of civil society" have their own axes to grind? One significant dimension of the problematic of the PEST is how non-experts can understand, discuss and debate the latest developments in S&T such as NT and its most notable products. The question of the PEST is challenging because it is fundamentally about the participation of non-experts in S&T. In this regard, Melissa Leach and Ian Scoones proposed a set of 'citizens' commissions for S&T futures at the local, national and global scale in developing countries addressing particular sectors, technologies or policy issues, and generate input and perception of people about S&T, and the way in which it should be governed.

It is needed now to develop an appropriate public education programme about NT. It will bring the involvement of many publics. Many people will get virtually all of their understanding about NT from such programme. The entire NT community – scientists, engineers, policymakers, social scientists, lawyers, journalists, indeed the public at large – has much to gain from efforts to put into wide circulation better information about the nature of NT and what its realistic opportunities and risks are. More than anything else, institutions should promote and support avenues for discussion about the issues associated with NT. By doing so, would help overcome the cross disciplinary and cultural boundaries. Only with such new habits in place, one can fully tap NT's potential while avoiding its problems.

Concluding remarks

The theoretical framework emphasizes upon the fact that it is difficult to predict the outcomes of any public engagement exercise based on the structural features and sponsors' objectives. It would be important from the policy perspective to gain an understanding on conditions under which these diverse range of initiatives emerge. To conclude, a prudent approach to engage with NT could be to address the interface between NT and society from the perspective of social equity, social purpose, and structure of economic and social enterprises. Towards this, building up expertise in social science research in NT and increasing investment on the issue of public engagement in emerging technologies could help immensely. Finally, negotiations and deliberations between experts and lay people would provide new directions for research.

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Reducing Digital Divide using Data Mining Techniques for Better E-Governance

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Abstract The term digital divide refers to the gap between people with effective access to digital and information technology and those with very limited access. In other words it is closely related to the knowledge divide or knowledge share due to the lack of technology and knowledge. The extraction of useful and non-trivial information from the huge amount of data available in many and diverse fields of science, business and engineering is called as Data Mining. Data Mining techniques and algorithms are the actual tools that analysts have at their disposal to find unknown patterns and correlation in the data. For effective use of E-governance in Tamil Nadu, the digital divide to be reduced. Most of the Government departments are already using E-governance in Tamil Nadu. This is the appropriate time for us to analyze the effectiveness and reach ability of technology to all sectors of peoples. Even the most learned peoples are reluctant in using the technology. This digital divide gap leads to improper usage of Information and Communication technologies. The objective of this paper is to analyze the following two important digital divide issues using data mining and present recommendations for better E-Governance in Tamil Nadu.

Improving Quality of Bandwidth / Parameters: Since, the information and communication technologies are being implemented in the Government at different levels; good bandwidth is needed for constant transformation of knowledge in a proper format. For the better usage of E- Governance, the quality and performance of bandwidth performance has to be increased. In Tamil Nadu, there are so many service providers available for connectivity. But, the expected quality of bandwidth is less than the assured bandwidth. This paper analyses the bandwidth parameters using data mining techniques and suggest a better framework for improving bandwidth across Tamil Nadu.

Taking Technology to reduce the gap: Now-a-days, many new information and communication technologies are introduced. The urban sector is reluctant in using the technology due to the fear of using the technology and also thinking communication/network failure, which occurs frequently. The middle age person still thinks that the technology is very far from them and also is very costlier. The rural sector is unaware of these technologies and they need to be provided infrastructure and training. With the increase usage of mobile phones; convergence of technologies also need to be thought of. This paper analyses the need of urban and rural sector people for the effective reach of technology. Data Mining Techniques are used for data analysis, which leads creation of to better E-governance standards.

The above mentioned parameters are studied by applying data mining techniques such as Association rule mining (determine implication rules for a subset of record attributes, Classification (assign each record of a database to one of a predefined set of classes analysis and Clustering Techniques (find groups of records that are close according to some user defined metrics) and a suitable framework is proposed for better E-Governance.

Keyword: Data Mining, Digital Gap, QoS, Bandwidth.

Introduction

When the IT industry increased globally in the 19th century, simultaneously the Internet and the Mobile technologies are also emerged into the world and ruled majority of the people. With this, E-Governance also booms out with the help of some Government Departments around the world. In India, National Informatics Center

(NIC) played a vital role for the development of E-Governance in which they incorporate some of the Government related activated like Tax payment, Census Generation, Election Management, Disaster Management,[1] etc.,

In Tamil Nadu, some of the successful E-Governance projects are land registration, call for tender, issue of birth/death certificates, agriculture, e-transaction, RTO, tourism, infrastructure, land/local tax, local body election details, e-ticket etc., [1]. The major scenario in the above-mentioned successful E-Governance is heterogeneous based System. The entire activities of each Government related activities posses a unique database to store their respective data. This technique is followed in our state and also other states too [2]. As a fact, each Government department maintains their own database as unique and there is no interlinking between various departments/databases. When, the land registration department needs some information about agriculture data, they are not able to access the agriculture database. This leads to minimum usage of the e-governance projects by the citizens. The digital gap increases due to the issue and the important e-governance projects fails after implementation. This paper proposes the use of data mining techniques and a better framework to reduce the digital gap and to interlink the heterogeneous databases. This paper proposed two stages to reduce the digital gap:

a. Improving Quality of Bandwidth / Parameters.
b. Taking Technology to reduce the gap

Using Data Mining Techniques to Reduce the Digital Gap

Data Mining is the technique to explore and analyze the large data sets, in order to discover meaningful patterns and rules [6]. The evaluation of data mining techniques began when the business data are stored in the database and the technologies were generated to allow the user to navigate the data in the real time.

Recently, the ICT made a proposal for all the state and central Government for the betterment of database maintenance in the near future generation [3]. As we know, now a days, all the Government departments utilizes huge amount of data in their day-to-day work, which leads to maximize the access of current or history of datasets from the database [2]. But, it is not possible to fetch the datasets when they need. This is because of insufficient data, improper format, duplicated data, and some technical problems etc.,; When we discuss on other side, it is also due to less bandwidth, natural disaster, network failure, and loss of data during data transmission and collision of packet with one another etc. As a result of this, the end user cannot able to perform the operation with in the time and also little afraid to continue the E-governance system. Since, a gap is generated between user and existing E-Governance systems. As a result, the Government should concentrate on above set problems for the betterment of E-Governance. By considering these issues, this paper proposes the use of data mining techniques to reduce the digital gap. The major data mining techniques considered in this paper are [6] ;

a. Association Techniques.
b. Classification techniques.
c. Clustering Techniques.

Association: It is method for discovering interesting relations between the variables in the large database. There are different types of algorithm for association rule. They are Apriori algorithm, éclat algorithm, FP-growth algorithm, One-attribute-rule algorithm, Opus search algorithms, and Zero-attribute-rule algorithm [6]. Let us consider the existing E-Governance agriculture database as an example. Suppose, when a user needs a land for the cultivation process with the following features, i.e, good water, larger area, good manpower, and good soil. Based on the above features, the end user can easily search the availability of lands form the existing database with the help of some association algorithm. The one of the best algorithm for technique is Apriori Algorithm.

Classification: It is one of the data mining techniques used to predict the group for data instance. Some of the popular classification techniques are decision trees and neural networks [6]. From the existing database, the end user can classify the land with required parameters like state wise, of district wise, area wise and etc by means of tree like structure. By this classification technique, the user can easily classify the required data from the existing database using some protocols. Based on this, the user can identify the locations and nature of the land with a faster manner. Some of the best and easiest algorithms are decision tree and nearest neighbor algorithm that is available in data mining techniques for better classification.

Clustering: It defined as collection of data object that are similar to one another within the same cluster and dissimilar to the objects in the other cluster. Clustering algorithms are broadly classified into hierarchical and partitioning clustering algorithm (Jain and Dubes, 1988). Again, the Hierarchical algorithm are Agglomerative and Divisive algorithm and the Partitioning Algorithms are k-means, k-mediod, DBSCAN, CLARA, CLARANS, BIRCH CLIQUE, OPTICS etc [6]., When a person is willing to find the group of land for cultivation respective of location, the user can apply the clustering techniques with the existing e-governance database to form a new groups based upon the user requirement. Thus the user may satisfy. This is the appropriate time for us to discuss the effectiveness and reachability of technology to all sectors of people. Even the most learned people are reluctant in using the E-Governance technology. This digital divide gap leads to improper usage of Information and Communication technologies. By using the above specified data mining techniques, the digital gap is reduced which in turn help the state to move towards implementing better and quality of E-Governance projects.

Improving quality of Bandwidth / Parameters for Better E-Governance

In general, some of the service providers like BSNL, AIRTEL, etc., are available for network connectivity in Tamil Nadu for good quality of Bandwidth. Bandwidth is defined as amount of data transferred in a given period of time [8]. Since, each service providers are having different qualities of bandwidth. But the expected quality of bandwidth is less than the assured bandwidth. As result the network connectivity in Tamil Nadu reached towards down state. Due to this, the successful E-Governance projects get failed while performing data transactions. By considering the above facts, the quality of service (QoS) need to be improved and also all the service provides are expected to provide guarantees for constant network connections. Bandwidth is one of the major constrain for better E-Governance. Some of the parameters are identified to rectify the poor bandwidth problem. For constant connectivity and the better usage of e-governance, the identified parameters are as follows [8]

a. Availability
b. Throughput
c. Data latency
d. Error rate
e. Network Traffic
f. Routing Performance.

Availability: It is defined as the probability that a device will perform a required function without failure under defined conditions for a defined period of time. In most of the case, availability is an important characteristic of system but it becomes more critical and complex issues on networks. With the help of Data Mining technique the network availability are classified with various parameters and helps the service provided for better network availability. Thus, by applying the classification techniques in network database, availability problem will be rectified.

Throughput: It is defined as the rate of communication links or network access. The Throughput is generally measured in bits per second, and sometimes in data packets per second or data packet per time slot. By applying the data mining association algorithm, the service provided will come to normalize the size of the packet for data transformation from one place to another with respect to time and network availability. Based on the mining techniques, the problems are identified and help in future that is not repeated.

Data latency: It is defined as how much time it takes for a packet of data to transfer form one destination point to another destination. The latency mainly depends on the nature of the electromagnetic signal. Thus the latency may be differing from device to device. Hence, data mining association techniques are applied on the history dataset to identify when the problem happens and how the problem happens; Is it happen previously? If yes, what actions are taken to solve the problem?

Error Rate: It is defined as the number of received bits that have been altered due to noise and interference while during digital data transmission. The error rate may vary from device to device and software application to application. Thus by applying clustering techniques, the service provider can mine the error rate with respect to the hardware and application software from the previous data. Based on this method, the service provider knows which application software Vs hardware device suppose to minimize the error rate.

Network Traffic: It is defined as the data in a network, where the network traffic controller controls the traffic, bandwidth, prioritizing the data packet while during transformation form one point to another. The major part is to measure the network traffic like where the network congestion happens, with this, the classification techniques are applied and the same issue was happen in the previous days or not. Based on the result, the identified problems are rectified.

Routing Performance: It is defined as measuring the performance of the router depends upon the load offered of it, i.e. by means of heavy load of test traffic will reveal the performance. Based on the traffic and load the performance may vary. For better performance, the traffic should be shaped and the packet size should be constant throughout the entire process. With the help of data mining classification techniques, the provider can mine the lesser traffic network for better routing performance.

Network problem happens not only due to technical side but also due to natural calamities, breaking of cable, etc. From the above scenario, the Central or State Government has to rework on the above-mentioned areas to improve the bandwidth performance by means of advanced networking technology, Fiber Optic and recent computing technologies will acted as catalyst for improving bandwidths.

In this paper, bandwidth parameters are analyzed with the help of few data mining techniques for network connectivity to improve the bandwidth. The framework is developed to provide better network connectivity for E-Governance. This paper analyses the bandwidth parameters using data mining techniques and suggest a better framework for improving bandwidth across Tamil Nadu.

Proposed Frame Work for Reducing the Digital

In Tamil Nadu, there are more successful E-Governance projects being implemented. But, all the implemented applications are heterogeneous in nature *i.e.* the databases are not linked for effective usage. Due to the non-linking of databases and availability in different geographical locations, there exist a digital gap. In the proposed framework, a new concept is introduced to reduce this digital gap, instead of storing the data in different location. This paper proposes the creation of data warehouse, which is a subject-oriented, integrated, time-varying, non-volatile collection of data [5][7].

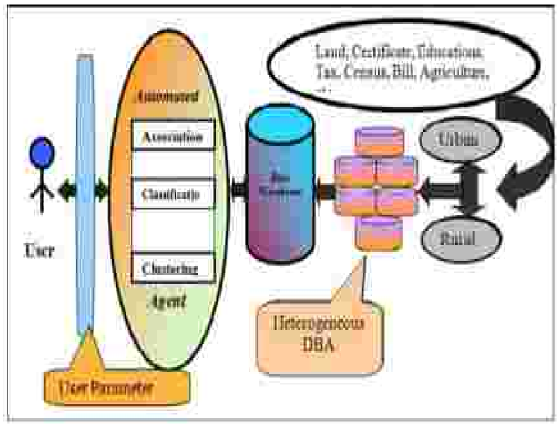

Figure1. Frame work for betterment of E-Governance in India

All the existing and emerging E-Governance databases which is heterogeneous in nature and available in geographical locations are combined and get stored in a common place called 'Data Warehouse'. It may be called as state data warehouse or data repository. The users using a particular E-governance application is able to use the other application also effectively thereby the usage of E-governance applications are increased. Thus, digital gap is also reduced.

From the above figure1, the E-Governance technology/applications data are collected from different locations and get stored in different database. This paper proposed a framework in which all the heterogeneous databases are combined and stored in one common place called data warehouse [5]. It contains the summary of all the data, which are made available in a day today process. As per this concept, anyone can access any kinds of data at any time by the data warehouse with a faster way. Different data mining techniques are also made available in the proposed framework. By applying these data mining techniques based on the user requirement, the user can mine the data with meaningful order, proper format and in time [7]. Hence, the Tamil Nadu Government E-Governance projects are used more effectively than other State Government projects. With this work, the technology gap is also reduced and the users may utilize the E-Governance by higher level.

Conclusion

In this paper, the importance of digital gaps and the parameters for reducing the digital gap with the E-Governance in Tamilnadu are discussed using different data mining techniques for the better performance. Various network Quality of Services (QOS) parameters such as availability; throughput, data latency, error rate, network traffic and routing performance are considered in data mining perspective to increase the available bandwidth. With the help of proposed framework, the gap also gets reduced between the user and the E-Governance systems which enable the Tamilnadu government to implement successful projects.

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Looking at Communicating Science for Ecosystem-Based Management

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Abstract. This seminar will look at science communications as a mechanism for integrating science into an ecosystem-based management research partnership. Using new and applied methods the Hawai‘i Institute of Marine Biology (HIMB) Northwestern Hawaiian Islands Research Partnership will be used as a case study looking at the intricacies associated with science management integration. This application to a specific partnership has both global and local significance dealing with large-scale marine ecosystems. Partnership participant’s attitudes and perceptions towards science communication and interdisciplinary integration will also be explored. Evaluation and application of lessons learned will be used linking theory and practice. A review of the current science management literature will also be included exploring how the research partnership and new large-scale ecosystem based management fits within science communications. The Papahānaumokuākea Marine National Monument (Northwestern Hawaiian Islands) is an excellent example of science management integration, with various stakeholders and the recent designated as an UNESCO World Heritage Site. Managing this area using an ecosystem-based approach takes a team comprised of natural and social scientists, managers, educators and policy specialists. HIMB is distinctive in that its faculty has been conducting ecosystem based research in the Monument for over five years. Unique and biologically important science is used to promote an understanding of complex ecological systems and topics such as biodiversity and climate change to management and communities within the Hawaiian Islands. Successfully amalgamating marine science concepts using interdisciplinary approaches, this program has worked to develop a sense of place in the community, strengthening relationships between schools, neighborhoods, and society.

Study of the Communication Methodology for Aadhaar and Issues in it's Acceptance and Adoption by the Common Man in India

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Abstract. Information science, an imperative aspect in any innovation enables people at the 'Bottom of the Pyramid' into entrepreneurs. In recent time new modes of communication are being governed by varied government, and non-government institutions. In the niche of innovations 'Aadhaar' has attained paramount importance in terms of aquaintance and usage of communication technologies to simplify pulls and pushes confronted by common man of a highly populated developing country like India. The Objective of this paper is (a) To understand how the communication for UIDAI (Aadhaar) is being planned and undertaken .(b) To study what can be the issues in it's acceptance and adoption. 'Aadhaar'–UIDAI is an example of a methodology to bring revolution in not only how people access technology, but also in how the country is governed, starting with the domain of national and social security. It is being developed to be a multipurpose National Identity card. This unique identity card, it is believed would help address the issues related to subsidies and prevent embezzlement of funds for poverty alleviation programmes such as NREGA, other than the issues related to national security. It uses the technology of asymmetric key cryptography and symmetric key cryptography. India being a unique country with it's diversity in culture and traditions, a methodology of the kind of 'Aadhaar' would require distinctive and customized solutions for communication and adoption. We would be considering some cases in perspective and how the 'Adhaar team' are coming up with tieups and methods to cater to such issues. The name 'Adhaar' as well as the logo signify 'foundation and hope' and can be well associated with by the people of India. We would also be considering similar examples from other countries and the challenges faced by them during the initial years of adoption and how they solved such issues. In addition, we would also refer solutions based on expert opinion and our own perspectives. Secondary data and expert opinions would be considered for writing the paper. Implications and value: The paper envisages to understand and present a general perspective on mass communication, adoption and acceptance of 'Aadhaar' which has social, political and economic relevance.

Keywords: Information science, Entrepreneur

Public Relations as an Important Tool of Science Communication with Society: The Case of Poland

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Abstract. In the field of science, Central and East European countries (CEECs) have inherited various relics from the past, among them:

- bad communication between science and society,
- low level of public understanding of science (PUS),
- weak co-operation between the science sphere and the production sphere,
- small scale of commercialisation of science,
- practically non-existent infrastructure of scientific and technological knowledge flows in society.

At present, the market reforms in CEECs are far advanced. So now, the main direction in their developments is to build knowledge-based economies/societies. In reforming Central and East European countries towards modern market economies, the science sector faces numerous challenges. Among them, there is the challenge: How to communicate better with society? There are various tools of such communication. One of them is Public Relations (PR). The main aim of this paper is to prove the big potential role of Public Relations as a communication tool between science and society, with a special reference to CEECs. Poland will here be a case-study.

The following issues will be analyzed in the paper:

1. The role of science communication: A brief survey of the literature
2. Public Relations as an element of marketing communication
3. Polish experiences: A short evaluation
4. The desired role of Public Relations in science communication
5. Conclusion

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Understanding Snake-bites and Soil Salinity–Science Communication over "New Media"

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Abstract. The Understanding of and application of scientific principles holds the key to technological progress and developmental goals of any nation. Rural India is characterized by poverty, illiteracy, infrastructural inadequacies and the myriads of ills that plague those below the poverty line in the third world stemming largely from the lack of scientific awareness, and spread of community knowledge.

Over the past decade information and communication technology (ICTs), specially new media like the Internet has brought information access far closer to the rural populace. Information Kiosks have been set and cellphone coverage has scaled rapidly.

These new forms of media provide unforeseen opportunity in spreading scientific awareness that can help overcome superstition, improve health care and even provide access to income. However technology options are not sufficient by themselves. Public communication for dissemination of scientific knowledge needs to be participative in nature and focus on the needs and benefits of the community itself. Implementation of such projects needs to take a holistic view that encompasses a multi-disciplinary approach towards the problem.

This paper presents some experiences as well an approach and a plan for a large scale intervention of scientific knowledge with community participation that can be successfully implemented utilising the existing investments in basic infrastructure. This is largely drawn on our previous experience in working with the rural community and building a successful effort of capacity-building and livelihood generation for the rural community in Sunderbans.

Keywords: Capacity-building, Community, ICT4D, Information technology, New media, Poverty, Rural knowledge centers, Science communication, Village information networks

Introduction

The past few decades have been marked as much by technological progress as its inability to address or even impact the issue of poverty eradication. In most developing economies, the Human Development index (HDI) is fairly low even in the face of rapid economic growth. In India–a country that can take pride in its technological advances and its growing economy–the HDI ranking is at 128 for 2010 and 134 for 2009, among 182 nations.[1] The Multi Dimensional Poverty Index (MPI) developed jointly by UNDP and Oxford recently show many states in India with poverty levels lower than many areas of sub-Saharan Africa.[2]

The demographics of the citizens of India based on the census of 2001 shows that 72.18% reside in the villages while 27.82% live in Urban areas and only 13.20% of these are in cities of population 500,000 or above.[3] This large percentage of citizens survive on an income below the poverty line of $1 a day and have a very low literacy level, and their exposure to Information and Communication Technology (ICTs) are almost nil.

The disparities in income are wide between the educated urban elite and the impoverished rural people for whom even earning the bare minimum is daily challenge. Lack of basic scientific knowledge on health and hygiene makes much of the population prone to disease and vulnerable to exploitation. This trend is not isolated but manifests itself in other developing economies as well.

New Media–Opportunities

So what impact can technology really have in overcoming the problems we face in public dissemination of scientific knowledge?–the topic of this particular conference and the deliberations of the past few days.

From the 1980s India has extensively used the national television channel for broadcasting scientific information to the people. Through a programme under the University Grants

Commission, educational and scientific programmes are prepared at universities by students of mass communication and televised. But television content, which does not allow interactivity, still remains as a traditional form of media.

What is new media?

The question is what exactly do we mean by "New Media"? It is a common perception that any form of electronic content, broadcast TV, radio, electronic music played on computers or static pages on the Internet classifies as under this category. But digitisation alone does not define new media.

New Media technologies are better defined as those which allow the user full interactivity, in deciding the access to the content, and perhaps even the form of information, like text, language, video or audio. New Media thus allows "on-demand" access to content keeping the users in control of what choices they make. This option for interactivity is enabled by the technology of to-day whether it be the Internet through computer terminals or access to TV channels over a mobile device or even an IVRS information retrieval system.

We all know how advent of Internet and communication technology has changed the world we live in to-day. Instant delivery of information that you need from anywhere in the world is possible in a matter of minutes, even seconds. Scientific and technological research can now be shared seamlessly across geographical boundaries. It is said that Internet is not just a new Media – it is a new way of life!

Bridging the "digital divide"

But till recently all of this was the prerogative of only the rich educated elite in India and this led to the coinage of the term "Digital Divide".

The Indian Government was guided by the Millenium Development Goals set up by the United Nations to create a world free of poverty by 2015, which declared a commitment to "make available the benefits of new technologies especially information and communication technologies (ICTs)"[4]. Subsequently a number of initiatives have been taken by the government of India to extend the reach of these technologies into rural populace and cross this so-called divide.

Mission 2007 was initiated to provide access to information to the 600,000 villages in rural India. About 100,000 "Information Kiosks" called Common Service centers (CSCs) have been set up in 1 in 6 of these villages in a Public-Private-Partnership model. These have been linked to the State Wide Area Network and are operated by Village Level entrepreneurs.[5,6] While primarily meant for delivery of government services there is an unlimited opportunity to access this ready infrastructure for the purpose of interchange of scientific and technological knowledge with the rural communities.

The Indian government simultaneously focused on increasing rural connectivity both through Cellular bandwidth expansions. Cell users in urban areas are taxed by the federal government to help build a corpus fund called "Universal Services Obligation Fund" [7,8] which is then invested in infrastructure for cellular coverage in rural areas. In recent years the growth of cellphone usage in rural areas, with the simplicity of voice communication that can be used even by those challenged by technology or education, has overtaken the revenues generated in urban areas!

This infrastructural backbone can then provide a robust and effective platform to meet the objectives laid out under Public Communication of Science and Technology – namely "the ability to respond to technical issues and problems that pervade our daily lives and an appreciation of the way science works and how the community can interact with science to help shape its work".

From the technology perspective it appears to be an ideal scenario and it is tempting to suggest an all pervasive solution where scientific information is provided as content; and we wait and expect that the community will benefit. This is no more than the using new media in the same broadcast mode of the earlier technology like radio or television. While dealing with rural community it is extremely important to understand the impact of these tools and to effectively utilize them; and to illustrate this we share some of our experiences from our previous experiences in working in the areas of Sunderbans, part of the Gangetic delta in West Bengal.

The Rural Perspective–(Sunderbans)

"*Sunderbans*" part of the Gangetic delta basin –the world's largest delta, is also one of the poorest sections of the world. Sunderbans is a World Heritage site of UNESCO, which straddles the countries of India and Bangladesh. The Indian part is home to about 5.4 million people a very high population density for a rural area.

The Sunderbans have no cities, just scattered villages and islands where there are settlements and protected forests. Travel between the islands is mainly by boat. The community traditionally has agricultural and fishing livelihoods. But the produce–fish, timber, agricultural produce, honey is shipped to the urban areas for further processing. There are no industries and the per capita income of the inhabitants is largely unknown; the reported figures show 37% living below the poverty line quoted at the figure of $1/day, but in reality the percentage is far higher.

Figure 1. Travelling in the Sunderbans

The area is disaster-prone and often ravaged by cyclones. The largely fishermen community also remain at risk, due to lack of effective disaster warning systems.

The youth of the region often do not complete their formal education as they cannot attend schools regularly due to long sailing trips on fishing trawlers where they work as hired labor as sole bread-winners in their family. Those who do have the means to get an education – there are schools and even many government run "colleges"–are excluded of the livelihood opportunities due to lack of skills and capacity for the workplace. The rural youth migrate to the urban areas but with *no exposure to computers*, considered a basic tool at the workplace of to-day, they would find themselves excluded.

Our organization, in partnership with another philanthropic agency, Anudip Foundation ran the ICT-based Skills training project for rural youth, in this region, leading to livelihood options. Many of the youth trained by us have been operating the Information Kiosks under the CSC scheme in this region. [10]

Figure 2. Rural Internet Centre

Community Needs and Relevance of Scientific Knowledge

In June 2009, the cyclone Aila hit West Bengal and many areas of this region in the Sunderbans was affected by flooding and isolated from the mainland. Relief efforts included food and medicine supply but for many of the people who were homeless, without any shelter the problems of health care were critical. For many of these people the critical need for "scientific knowledge" at this juncture were precautions on how to avoid infection and what measures to take. Sometimes even age-old remedies were shared across villages, especially where infrastructure made it hard to reach medicines. Simple precautions like boiling water, or even regularly washing hands and lessons in hygiene had to be shared across the community.

Post cyclone one of the major hazards that emerged was the proliferation of snakes due to the flooding of ground and old buildings. A local Community Based Organisation (CBO), Aikatan, developed a set of posters that could be used by the villagers to quickly identify the poisonous variety of snakes. It is well known that in case of snake bites, many deaths are more due to shock and fear. Confidence to identify the poisonous variety of snakes and basic first-aid techniques go a long way in being prepared and are welcomed by community. Groups of youth toured many villages in the area with these posters.

During the cyclone another problem that arose was the breaching of many of the embankments near the villages. This meant that the saline water creeped into the agricultural lands and made cultivation impossible. For the rural poor whose only livelihood option was the farming produce–there was little choice left to them but for migration to the city in search of work they were ill-qualified for.

What scientific options could have been made available for quick desalination of the soil? What crops could be grown in this saline soil? These were the scientific questions that needed answers–the relevance of the problem and quick solutions needed would make the interactive approach of the new media the most suited for cases like these–and perhaps this would lead to the means for poverty eradication.

Holistic Approach

These experiences shared by the community during and after the cyclone Aila clearly brought to focus the need for the relevant scientific knowledge, as applicable to the situation. Information needs of the rural Community are quite different from the urban populace, and many of us as "outsiders" do not perceive this while disseminating scientific knowledge. The need for the community members to identify the requirements for knowledge areas must be clearly the focus.

Development practitioners have widely accepted that community interventions need to be participative in nature as no external effort can be sustainable. Tools like PRA have now become the standards for any development initiative to ensure that there is a complete community buy-in, and the community itself is a stakeholder, otherwise any development goal is unlikely to be met.[9]

For the dissemination of scientific knowledge a similar approach needs to be followed. Community members as stakeholders need to identify the critical areas of knowledge. Perhaps the same Participatory tools which are used in the social sciences can be used here, with a few community members being assigned pivotal roles. Thus to effectively disseminate knowledge we need to take a multi-disciplinary holistic approach encompassing social science, technology and the basics of scientific principles. Not only that the exchange must be a two-way process. Traditional knowledge sometimes residing in the rural communities must also be captured and shared and it is exactly this type of processes that can be effectively supported by the new media technologies that are available to-day.

An Implementation

The network of Rural Information Kiosks available today provides the best opportunity to implement this knowledge sharing. The village level entrepreneurs who operate these kiosks enjoy the confidence of the community and are well aware of the problems that they face. In fact much of the problems illustrated by us have been shared through their experiences.

What is really needed is the option to be able to upload and share problems that need technological or scientific solutions. These need to be addressed quickly and effectively and answers need to be given by people who have both the scientific know-how as well as experience of working in the community so that the solution has relevance.

Our proposal is to build a rural knowledge portal in local language that can help add to the knowledge base. The technical solution would have the following:

1. A web Portal where the community can upload their questions and problems.
2. A facility where they can also upload and share solutions, or knowledge (as in the case of the snake-bite awareness programme).
3. An Interactive Voice Response system that allows for community members to call-in and check for simple problems
4. A Help-line where community members can actually speak to a person who would provide answers (this may even be the Information Kiosk operator who can tap the local knowledge base).

With this simple set of technology infrastructure it may be possible for us to extend the reach of scientific knowledge to millions and provide them with an option for improving their livelihoods. It appears such a simplistic solution, we wonder why this has not been done, and if it has, why it has not worked in the spread of scientific knowledge?

The reason is that technology alone can not be considered as a solution – it is the community that needs to take the ownership and there are several barriers that need to be overcome for this to be an effective method to meet our goals. Technology cannot be the driver for communication, it needs to be the slave.

Key success factors

So what are the key success factors that can help us use this technology to meet the goals of objectives that PCST 2010 has laid out? The PPPO model which takes into account not just the technological backbone but the people, process, participation and ownership is perhaps the most effective means to achieve this.

People: The most critical aspect of using any technology is the need to understand it and control it. Empowerment comes when people feel that they are in control of the systems that they are using. Fear of technology inherent in people and more so in the traditionally rural background this continues to remain a barrier. It is therefore necessary to overcome this critical area first.

Technology challenges can be conquered only when people learn to use it. The ideal solution for this is simple usage methods, and graphical user interfaces, perhaps even technology like touch screen that can be easily learnt by the rural community in the villages.

The key to the successful implementation of this project then lies in capacity building for the community or even the kiosk operators/village level entrepreneurs who by nature are trusted as they belong to the community itself.

Process: The next barrier is in the process of disseminating or even collecting scientific knowledge. The scientific body of knowledge needs to be formulated and this is an area where the easy uploading of content in the form of sharing experiences, can be extremely effective. Traditional knowledge sharing needs to be encouraged. It is better than the earlier “broadcast” modes of only the experts being expected to upload the knowledge.

For community members, perhaps a remunerative model where those who upload content can be paid nominal amounts may work as an incentive to gather the real knowledge base residing in our rural communities. This would also add a livelihood and income option to the poor communities and encourage use of the large number information kiosks and internet centers that have been already set up.

Participation: Equally critical is the relevance and access of the scientific principles itself. If answers to questions are available at the time of need, that is when the public communication of scientific knowledge will be useful. Rural communities do not have the time or luxury to use technology as an entertainment tool, for them it must be a utility, accessible when needed for helping them in their struggle for daily living.

Ownership: And finally the community needs to feel the ownership of the knowledge base and the technology available through their local access means. The oft-quoted words of Abraham Lincoln’s Gettysburg address for government “of the people, for the people, by the people” [11] needs to extend to scientific knowledge for the grassroots community and only then can we achieve our desired goals.

Conclusion

While this paper outlines the use of new Media in public Communication of Science and technology, our role has primarily been in capacity building among the rural communities. We are also part of the Rural Knowledge Network (Grameen Gyan Abhijan) in India which strives to promote this free flow of information between diverse rural communities in India.

Our future plans include more stress on developing content in this area of scientific knowledge, both from expert knowledge sources as well as from the rural community. We also hope to extend our model to use not just Internet and computer based access, but also cellular and voice communications which can even overcome the barriers of language and literacy.

Acknowledgements

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Multipronged Approach for Popularization of Science and Technology among the public

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Abstract. The rate at which Science and Technology is advancing in the world is simply unimaginable. It needs superhuman efforts to communicate Science and Technology to the public. However a large number of steps are already being taken by Govt. and Non-Govt. organisations in this regard. Yet it is inadequate. One solution appears to be to make it a mass movement. For this a multipronged approach may be made to expose and train the heads/leaders of various groups who can take Science and Technology down to the individuals at grass-root level.

Keywords: Mass movement, MP, MLA, Multipronged approach, NCSC, Panchayat raj, People's representatives, Science centres, Student

Introduction

A glimpse at the steps taken in the past for popularisation of science by Govt. and Non-Govt agencies would indicate that, perhaps no stone has been unturned in this regard. Some are useful, some very useful and some are excellent.

Pamphlets, Leaflets, Articles in Print Media; Books, Magazines, Radio, Television, Talks, Debates, Jathas, Slogans, Morchas, Posters, Flagmarch with placards, Exhibitions, Museums, Quiz Competitions, science based Cultural programs and Folk art etc; are only indicative and not exhaustive. Prizes are also awarded as incentives for all these.

Yet, it appears, there is much more that can be done.

Can this be converted to a mass movement - a movement to which people from all walks of life can be roped in? They can be made to be actually involved and contribute significantly in their own way.

Multipronged approach

Yes! It is possible. For this we can have a multipronged approach. We have to identify the groups, create awareness among their leaders/heads and train them. An approach can be to identify them by their age group, level of education, their pursuits of daily life, vocation, profession etc. For example, we have students, teachers, doctors, politicians, peoples' representatives, administrators, assistants, scientists, business people, corporate houses, social workers/self help groups, women groups, tribal groups, industrialists, labourers in organised and unorganised sectors; armed forces of all wings and paramilitary forces etc.

These different groups have different levels of education, understanding, exposure and interest. Hence, while taking science to them, we have to adopt different approaches, strategies, methodology, techniques and mediums.

One can design and distribute leaflets, booklets, documents for different groups, organise meetings, training programs, workshops and interactive sessions. The duration of the programmes can be varied, from a few hours to a few days and spread in different locations. For top echelons, we may choose Secretariat Conference Room, Administrative Academies; for MLA's, Assembly or suitable Halls; for MPs, Conference Halls; for Collectors/Block Level Officers, collectorate conference halls and so on. For the grass root level, there are respective Panchayati Raj office premises. These meetings or workshops can be replicated for similar groups at other locations.

The leaders in turn can take suitable steps for bringing science to the groups they head, formulate programs within their scope for inculcating scientific temper, removal of superstition and blind beliefs as well as appreciation of scientific activities & achievements at different levels.

Experience

The approach indicated above is based on some experience we had in Orissa, way back almost three decades hence, in the Department of Science, Technology and Environment when a massive program was launched for creating awareness on Environment - various issues involved, steps to be taken at different levels, the roles to be played by the various groups and individuals, policies to be advocated for adoption by Govt. etc. A number of incentives and awards were instituted. These have since become a part of the system and have done yeoman service for creating an impact on protection of the Environment in the State.

Another program recently organised by the P S Planetarium, under the aegis of DST, GOO is ‘Scientific Exposure Visit’ for students selected from 254 schools under Tribal Sub Plan of the state. Students were brought to Bhubaneswar, accompanied by some teachers and camped for four days. During this period, talks by eminent scientists and visits to scientific institutes, like Institute of Physics, IMS, PSP, RSC, RMNH etc; were organised. Participants made notes on their observations and had interactive sessions at the end of the day. Selected students were awarded prizes at the Valedictory function. This has been done for 2 years in succession. The participants had a rich experience which was communicated to their school mates.

Let us analyse some of the groups:

Students

Students constitute a major part of the society. As the future generation of the country, this group deserves maximum attention. Rightly so, a large number of programmes are being implemented. Besides science as a part of the curriculum, the other programmes implemented are Science Exhibition, talks or lectures, various competitions, National Children’s Science Congress – starting from individual schools, through Zonal level to National Level, participation with a focussed theme; visits to Science Centres under NCSM, though a very few in number; observation of various National Days like NSD, World Environment Day, Technology Day, visit to Science Express, though only a small section is benefitted; special programmes on TSE, Olympiads and so on.

Yet a few more things can also be done. More science based programmes can be broadcast by Radio, which can reach remote corners, where there is limited scope for TV. The scope of students from remote areas to visit Science Centres, Planetaria may be increased. The no. of Mobile Science vans and Mobile Planetaria and their frequency of visits can be increased. Popular Science Magazines in local languages, already available at subsidised rates, may be sent to interior schools, possibly at highly subsidised rates.

People’s Representatives:

India is a democratic country. Policies are made by People’s Representatives. Government Machinery is run by a vast network of committed Bureaucracy, overviewed by People’s Representatives. They are the persons who interact with people whom they represent. Hence Science should reach them first so that they can appreciate the programmes and in turn take them to the people. They should be briefed about the issues involved and progress in S&T made and achieved. That is the way their outlook will change, at least to a limited extent, help overcome superstition and blind belief, as well as create awareness of Health, Hygiene and Sanitation and protection of the environment.

- At National Level: Members of Parliament; Members of Rajya Sabha
- At State Level: Members of Legislative Assembly, Members of Legislative Council
- At Municipality/Corporation/NAC Level: Councillors, Mayors, Chairpersons
- At Panchayat Level: Panchayats/Sarpanch

Panchayati Raj

The Panchayati Raj is a system which enables people to run their own local Govt in rural areas. It functions at three levels –
The Gram Panchayat at the village level,
The Panchayat Samiti at the block level and
The Zilla Parishad at the district level.

In India, the system of Panchayats is very old. In 1992, the Central Govt. amended the Constitution and formulated rules for the Panchayati Raj System which became effective from April 1993.

The Gram Panchayat has various duties with emphasis on developmental activities such as agriculture, primary education, health and sanitation and responsible for implementing the Community Development Programme at village level.

- The Panchayat Samiti consists of elected members, State Legislative Members and Members of Parliament of that area
- Zilla Parishad, Apex body of the PR System, consists of elected body, MLAs and MPs
- These institutes of Local Self Govt. also help to bring about social change.

Local Self Govt. in Urban Areas

A Municipality or Municipal Council is Local Self Govt. body in smaller towns and cities. The population of a town or city determines the number of members in the Municipality (usually in between 15 to 16). A head of the Municipality is called Commissioner or President.

In case of large cities, the Local Self Govt. body is called Municipal Corporation. The number of elected members is usually between 50 and 100 (may be more as in Delhi and Mumbai–134 to 221). The head is known as Mahapur or Mayor. The functions include:

1. Public Health and hygiene
2. Public conveniences
3. Registering Births and Deaths
4. Education
5. Solid Waste Management.

A Nagar Panchayat is set up for an area that is changing from a rural to an urban type – Transitional area.

State Legislature

Legislative Assembly (Vidhan Sabha or Lower House)–The strength of State Legislature varies according to the population of the State concerned. The total strength for all States/UTs in India is 1485.

Legislative Council (Vidhan Parishad or Upper House)–The strength varies as per the population of the State, limited to 1/3rd of the strength of Legislative Assembly.

Parliament

- Lok Sabha: Maximum strength is 550 + 2 nominated members (530 States and 20 Union Territories).
- Rajya Sabha: Maximum strength is 250.

In the preceding paragraphs, we have mentioned the People's Representatives of various categories starting from Panchayat Raj to Parliament. This indicates how effective our approach would be if they are individually and severally groomed in Science and Technology by way of exposure and training, however short they may be.

Women's Group

Currently with the support from different programs at State and National level, several Women groups have become active and are undertaking activities for socio-economic development.

We may focus S&T communication for this group which will be very effective in achieving our objective. Once women groups are involved in promoting scientific temper, future generations will automatically develop the same attitude.

Scheduled Caste & Scheduled Tribe Group

The SC/ST Group constitutes a significant percentage of the population in several States. Along with the development programs they may be exposed to Science and Technology in an appropriate manner to appreciate the role of S&T for Socio-Economic development and well being besides developing a scientific temper and removal of superstition.

The approach would be to start with local problems/ issues like agricultural production, drinking water, sanitation etc. offering solutions with S&T inputs.

Extract: When seeds and kernel from 5 ripe drumstick are powdered and added to 10 litres of turbid and polluted water, the water will become clean and pure 99.9% of all indicator bacteria will be free. Such proven technologies can be taken to tribal people for whom it is culturally acceptable, inexpensive and ingredients locally available. This is an extract from a book with more than 500 natural coagulants which has been published.

This approach can be followed at Village and Panchayat level.

Corporate Bodies

In addition to the above, there is another group/section that may also be roped in. They are the officers of Major Corporations who contribute to programme of Social Relevance. In fact the Social Corporate Responsibility is now a programme built into the system/organisation. They are already doing yeoman service for the welfare of the society where they are active. All that one has to do is to groom them to bring in S&T inputs into their programs and activities.

Strategy

The strategy shall be to approach different groups suitably, keeping in mind all aspects described earlier. For example, the people's representatives at National level may be groomed about Science & Technology in broader perspective so that, not only can they appreciate the S&T policies at the highest level, but they may also contribute inputs, keeping their areas in view. In turn it would help them in monitoring the efficacy of the system. This would be similar, if not identical, at the State level.

In case of R&D Institutions & Scientists, it would be exposing them to fields of Science not dealt by them, and groom them to effectively take their contributions to the common man.

They may also get feedback from the people about problems and issues faced by them and find S&T intervention for solving them.

Taking another group, Doctors & Health Workers, they need not be restrained in their own profession but can be exposed to basic technologies involved in the latest equipments and methods of treatment including latest diagnostic techniques and therapy, application of Nano-technology, Nano-bio-technology, precision medicine, tele-medicine, Robotic Surgery etc. They may also be encouraged to study the unexplored areas and traditional systems etc.

A question may arise whether recruitment and training Role Models is implied in the approach. In a sense it is. Just as NCSTC supports Workshops for “Science Writers”, “Folk media”, to communicate Science through their arts like ‘Pala’, ‘Daskathia’, ‘Puppetry’ etc., people entrusted with/interested in popularisation of Science can meet, discuss and develop modules for different targeted groups and propagate S&T.

The Communication Institutes under NCSTC/DST can take the lead.

Considering the wide range of groups and population involved, and the benefits that is likely to accrue over long periods, the money, manpower and efforts necessary under this strategy is well worth it.

Conclusion

For effective communication of Science and Technology to the public, there should be a mass movement and a Multipronged Approach is strongly recommended.

Multipronged Approach for Popularization of Science and Technology among the Public

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Can this be converted to a mass movement–a movement to which people from all walks of life can be roped in? They can be made to be actually involved and contribute significantly in their own way.

Multipronged Approach

Yes! It is possible. For this we can have a multipronged approach. We have to identify the groups, create awareness among their leaders/heads and train them. An approach can be to identify them by their age group, level of education, their pursuits of daily life, vocation, profession etc. For example, we have students, teachers, doctors, politicians, peoples' representatives, administrators, assistants, scientists, business people, corporate houses, social workers/self help groups, women groups, tribal groups, industrialists, labourers in organised and unorganised sectors; armed forces of all wings and paramilitary forces etc.

These different groups have different levels of education, understanding, exposure and interest. Hence, while taking science to them, we have to adopt different approaches, strategies, methodology, techniques and mediums.

One can design and distribute leaflets, booklets, documents for different groups, organise meetings, training programs, workshops and interactive sessions. The duration of the programmes can be varied, from a few hours to a few days and spread in different locations. For top echelons, we may choose Secretariat Conference Room, Administrative Academies; for MLA's, Assembly or suitable Halls; for MPs, Conference Halls; for Collectors/Block Level Officers, collectorate conference halls and so on. For the grass root level, there are respective Panchayati Raj office premises. These meetings or workshops can be replicated for similar groups at other locations.

The leaders in turn can take suitable steps for bringing science to the groups they head, formulate programs within their scope for inculcating scientific temper, removal of superstition and blind beliefs as well as appreciation of scientific activities & achievements at different levels.

Experience

The approach indicated above is based on some experience we had in Orissa, way back almost three decades hence, in the Department of Science, Technology and Environment when a massive program was launched for creating awareness on Environment - various issues involved, steps to be taken at different levels, the roles to be played by the various groups and individuals, policies to be advocated for adoption by Govt. etc. A number of incentives and awards were instituted. These have since become a part of the system and have done yeoman service for creating an impact on protection of the Environment in the State.

Another program recently organised by the P S Planetarium, under the aegis of DST, GOO is 'Scientific Exposure Visit' for students selected from 254 schools under Tribal Sub Plan of the state. Students were brought to Bhubaneswar, accompanied by some teachers and camped for four days. During this period, talks by eminent scientists and visits to scientific institutes, like Institute of Physics, IMS, PSP, RSC, RMNH etc; were organised. Participants made notes on their observations and had interactive sessions at the end of the day. Selected students were awarded prizes at the Valedictory function. This has been done for 2 years in succession. The participants had a rich experience which was communicated to their school mates. Let us analyse some of the groups:

Students

Students constitute a major part of the society. As the future generation of the country, this group deserves maximum attention. Rightly so, a large number of programmes are being implemented. Besides science as a part of the curriculum, the other programmes implemented are Science Exhibition, talks or lectures, various competitions, National Children's Science Congress–starting from individual schools, through Zonal level to National Level, participation with a focussed theme; visits to Science Centres under NCSM, though a very few in number; observation of various National Days like NSD, World Environment Day, Technology Day, visit to Science Express, though only a small section is benefitted; special programmes on TSE, Olympiads and so on.

Yet a few more things can also be done. More science based programmes can be broadcast by Radio, which can reach remote corners, where there is limited scope for TV. The scope of students from remote areas to visit Science Centres, Planetaria may be increased. The no. of Mobile Science vans and Mobile Planetaria and their frequency of visits can be increased. Popular Science Magazines in local languages, already available at subsidised rates, may be sent to interior schools, possibly at highly subsidised rates.

People's Representatives

India is a democratic country. Policies are made by People's Representatives. Government Machinery is run by a vast network of committed Bureaucracy, overviewed by People's Representatives. They are the persons who interact with people whom they represent. Hence Science should reach them first so that they can appreciate the programmes and in turn take them to the people. They should be briefed about the issues involved and progress in S&T made and achieved. That is the way their outlook will change, at least to a limited extent, help overcome superstition and blind belief, as well as create awareness of Health, Hygiene and Sanitation and protection of the environment.

At National Level: Members of Parliament; Members of Rajya Sabha

At State Level: Members of Legislative Assembly, Members of Legislative Council

At Municipality/Corporation/NAC Level: Councillors, Mayors, Chairpersons

At Panchayat Level: Panchayats/Sarpanch

Panchayati Raj

The Panchayati Raj is a system which enables people to run their own local Govt in rural areas. It functions at three levels:

The Gram Panchayat at the village level,

The Panchayat Samiti at the block level and

The Zilla Parishad at the district level.

In India, the system of Panchayats is very old. In 1992, the Central Govt. amended the Constitution and formulated rules for the Panchayati Raj System which became effective from April 1993.

The Gram Panchayat has various duties with emphasis on developmental activities such as agriculture, primary education, health and sanitation and responsible for implementing the Community Development Programme at village level.

The Panchayat Samiti consists of elected members, State Legislative Members and Members of Parliament of that area

Zilla Parishad, Apex body of the PR System, consists of elected body, MLAs and MPs

These institutes of Local Self Govt. also help to bring about social change.

Local Self Govt. in Urban Areas

A Municipality or Municipal Council is Local Self Govt. body in smaller towns and cities. The population of a town or city determines the number of members in the Municipality (usually in between 15 to 16). A head of the Municipality is called Commissioner or President.

In case of large cities, the Local Self Govt. body is called Municipal Corporation. The number of elected members is usually between

50 and 100 (may be more as in Delhi and Mumbai – 134 to 221). The head is known as Mahapur or Mayor. The functions include:

1. Public Health and hygiene
2. Public conveniences
3. Registering Births and Deaths
4. Education
5. Solid Waste Management.

A Nagar Panchayat is set up for an area that is changing from a rural to an urban type – Transitional area.

State Legislature

Legislative Assembly (Vidhan Sabha or Lower House)–The strength of State Legislature varies according to the population of the State concerned. The total strength for all States/UTs in India is 1485.

Legislative Council (Vidhan Parishad or Upper House)–The strength varies as per the population of the State, limited to 1/3rd of the strength of Legislative Assembly.

Parliament

Lok Sabha: Maximum strength is 550 + 2 nominated members (530 States and 20 Union Territories).

Rajya Sabha: Maximum strength is 250.

In the preceding paragraphs, we have mentioned the People’s Representatives of various categories starting from Panchayat Raj to Parliament. This indicates how effective our approach would be if they are individually and severally groomed in Science and Technology by way of exposure and training, however short they may be.

Women’s Group

Currently with the support from different programs at State and National level, several Women groups have become active and are undertaking activities for socio-economic development.

We may focus S&T communication for this group which will be very effective in achieving our objective.

Once women groups are involved in promoting scientific temper, future generations will automatically develop the same attitude.

Scheduled Caste & Scheduled Tribe Group:

The SC/ST Group constitutes a significant percentage of the population in several States. Along with the development programs they may be exposed to Science and Technology in an appropriate manner to appreciate the role of S&T for Socio-Economic development and well being besides developing a scientific temper and removal of superstition.

The approach would be to start with local problems/ issues like agricultural production, drinking water, sanitation etc. offering solutions with S&T inputs.

Ex: When seeds and kernel from 5 ripe drumstick are powdered and added to 10 litres of turbid and polluted water, the water will become clean and pure - 99.9% of all indicator bacteria will be free. Such proven technologies can be taken to tribal people for whom it is culturally acceptable, inexpensive and ingredients locally available. This is an extract from a book with more than 500 natural coagulants which has been published.

This approach can be followed at Village and Panchayat level.

Corporate Bodies

In addition to the above, there is another group/section that may also be roped in. They are the officers of Major Corporations who contribute to programme of Social Relevance. In fact the Social Corporate Responsibility is now a programme built into the system/organisation. They are already doing yeoman service for the welfare of the society where they are active. All that one has to do is to groom them to bring in S&T inputs into their programs and activities.

Strategy

The strategy shall be to approach different groups suitably, keeping in mind all aspects described earlier. For example, the people’s representatives at National level may be groomed about Science & Technology in broader perspective so that, not only can they appreciate the S&T policies at the highest level, but they may also contribute inputs, keeping their areas in view. In turn it would help them in monitoring the efficacy of the system. This would be similar, if not identical, at the State level.

In case of R&D Institutions & Scientists, it would be exposing them to fields of Science not dealt by them, and groom them to effectively take their contributions to the common man. They may also get feedback from the people about problems and issues faced by them and find S&T intervention for solving them.

Taking another group, Doctors & Health Workers, they need not be restrained in their own profession but can be exposed to basic technologies involved in the latest equipments and methods of treatment including latest diagnostic techniques and therapy, application of nano-technology, nano-bio-technology, precision medicine, tele-medicine, Robotic Surgery etc. They may also be encouraged to study the unexplored areas and traditional systems etc.

A question may arise whether recruitment and training Role Models is implied in the approach. In a sense it is. Just as NCSTC supports Workshops for "Science Writers", "Folk media", to communicate Science through their arts like PALA, DASKATHIA, PUPPETRY etc., people entrusted with / interested in popularisation of Science can meet, discuss and develop modules for different targeted groups and propagate S&T.

The Communication Institutes under NCSTC/DST can take the lead. Considering the wide range of groups and population involved, and the benefits that is likely to accrue over long periods, the money, manpower and efforts necessary under this strategy is well worth it.

Conclusion

For effective communication of Science and Technology to the public, there should be a mass movement and a Multipronged Approach is strongly recommended.

Conservation Governance and Policy Monitoring of Ecologically and Economically Significant Gymnosperms in North Sikkim Himalaya

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Abstract. Environmental Conservation address environmental policy, practice, natural and social science at the global level. IUCN has recognized Teesta river basin, harbouring the elegant Gymnosperms in Sikkim as a part of Indo-Burma hot spot. Gymnosperms carry immense ecological, economical, and evolutionary, importance. Present proposal aims to make a study in Northern Sikkim (Lachung, Yumthang, Sevo, Lachen, Yakthang, Kalep and Thangu) for the planning of environmental conservation and management of the 18 species of Gymnosperms. Our main objectives includes, review policies on natural resource management and land-use; Analyse social, economic, and environmental issues and develop a framework of joint action between institutions.

Keywords: Environmental conservation, Gymnosperms, North Sikkim, Natural resource management

Introduction

Biodiversity is the product of spontaneous evolution during million of years. The concept of diversity relates to the species richness in the community. Biodiversity depends upon the intensity, predictability and scale of these interactions and essential biodiversity services to humans with traditional knowledge drive the phenomenon called “life” (Chandra *et al*., 2010; Obute, 2010; Suleiman *et al.*, 2010).

Environmental Conservation address environmental policy, practice, and natural and social science of environmental concern at the global level including issues of ecosystem change, resource utilization, terrestrial biomes, aquatic systems, and coastal and land use management. Community-based natural resource management (CBNRM) has been a pervasive paradigm in conservation circles for three decades. Despite many potentially attractive attributes it has been extensively critiqued from both ecological and sociological perspectives with respect to theory and practice (Baral & Stern 2010; Berkes 2004; Blaikie 2006). In focusing on the word ‘management’ there is very little research into situations where communities are the management agencies (Downsborough *et al.*, 2010; Ashenafi & Leader-Williams 2005; Ko *et al.*, 2010).

Gymnosperms in reference to North Sikkim

Teesta river basin in Sikkim (234 m to above 8,598 m); has deep valleys and ravines to gentle slopes in glaciated valley floors in north making it rich in floristic diversity. IUCN has recognized this region as a part of Indo-Burma hot spot. It also provides habitats and acts as a cradle for speciation and evolution of new species along with the genetic improvement of the cultivated species. The region also harbours the elegant Gymnosperms which are still less researched or untouched aspect in particular line of investigation.

Gymnosperms carry immense ecological, economical, ornamental evolutionary, industrial (aromatic, soap, perfumes, household sprays, floor polishes and insecticides, antifungal and clearing oil) and medicinal importance (bronchitis, asthma, epilepsy, snake bites and scorpion stings, aphrodisiac, induce perspiration, internal injuries, lung diseases and diabetes, carminative, antispasmodic, remove toxins from the bowel, increase digestive function and cure skin disorders such as eczema and psoriasis; Earle 2008; Shah *et al*., 2009; http://en.wikipedia.org/wiki/List of herbs and minerals in Ayurveda).

Globalization has ushered in an era of contrasts of fast-paced change and persistent problems demanding synchronization of national policies on a number of issues. An effective response to these challenges will require fresh thinking, refined strategies, and new mechanisms. Henceforth our research asks key questions: (1) How we can do ex-situ and in-situ conservation of Gymnosperms? (2) In parallel, conservation strategies, to promote economic integration in this regard? (3) What are the challenges that national governments face? (4) What institutional structure is needed to manage interdependence and to maximize the opportunities ? An equally rigorous and urgent reform of the environmental governance architecture is imperative. Present proposal is planned to make a study in Northern Sikkim (Lachung, Yumthang, Sevo, Lachen, Yakthang, Kalep and Thangu) and for the planning of environmental conservation management of the populations of economically and ecologically significant 18 species of Gymnosperms.

The prime objectives for gymnosperms conservation highlight Review policies on natural resource management and land-use emphasizing the gaps; Analyze social, economic, and environmental issues; Develop a framework of joint action between institutions in order to develop protected corridors, taking community participation as the key element; Establish proper priorities in terms of scarce resources allocated wisely in relation to education, or enhanced monitoring and observational systems; Recognize Culture, heritage and social structures in resource management and Enable Markets to work, as the prime land and shelter delivery mechanism.

Methods

Exploration in North Sikkim (Fig. 1). Despite having less forest cover (30%) North Sikkim is at top with respect to the number of flowering plants or number of endemic and threatened species of flowering plants mostly covering the area of particularly in Lachen-Lachung valley and Zemu valley. In recent times, the increase in human population as well as increase in various developmental activities have posed a serious threat to the floristic diversity of Teesta basin.

Fig.1 Locality map in North Sikkim

Analysis and monitoring of policies and institutions for their socio-economic and environmental impact, relating to Gymnosperms belonging to North Sikkim Area

(a) ***Linking environment and gymnosperms conservation and economic growth***

To devise more sophisticated and realistic policy approaches for allocating resources for Sustainable economic growth which is depending on the level, quality, and management of natural resources (R), environmental quality (E), and institutional governance capacity (I).

(b) ***Priority setting and strategic planning***

(i) Assisting partners to more effectively plan strategically and develop environmentally related policy and institutional governance programs

(ii) Engaging the participation of relevant stakeholders in planning initiatives, including the private sector, with special attention to participation by traditionally under-represented groups, such as women and indigenous people, spiritual or cultural incentives. of policies

4

(c) ***Dissemination of Environmentally Related Policy Knowledge Communications and Research***

- Strengthening the governance capacity of local governmental and non-governmental organizations Institutional information dissemination vehicles, including but not limited to, publications, seminars, workshops and the internet.

(d) ***Policy Analysis and Dialogue Support***

- Issue Recognition: Identifying and analyzing policy constraints and opportunities;
- Issue Diagnosis: Analyzing the economic, social, ecological and institutional aspects of alternative policies;

Issue Design: Analysis of alternative intervention strategies, approaches, and incentives or dis-incentives to change

- behavior.

(f) ***Policy Performance Monitoring and Evaluation***

Assisting partners to design and implement policy program monitoring and evaluation activities, both to promote adaptive management and to document results.

Observations

In Sikkim Himalaya, a total of 18 species of gymnosperms are recorded in Teesta river basin. Most of these species are trees except *Ephedra* sp. and *Cycas pectinata*, distributed mainly in Lachen-Lachung valley, Thangu region, Yumthang, Dzongri and Chhoka areas (Table 1).

Table 1 Gymnosperms of Sikkim Himalaya (www.sikenvis.nic.in/CCSOTB/Vol-VI_Socio-
Expected outcome (Including tentative titles of articles/ reports/ workshops):

Species	Family	Ver./Nep. name	Alt. (m)	Habit	Distribution in Sikkim	Uses
Cycas pectinata	Cycadaceae	Thakal	600-1050	Shrub	Singtam	Stem pith used to produce sago
Pinus kesiya	Pinaceae	Khasia pine	800-1000	Tree	Sangklang	Timber and resin
P. roxburghii	Pinaceae	Dhup	1000-1800	Tree	Rangit and Teesta valleys	Timber; trees tapped for resin
P. wallichiana	Pinaceae	Dhupi	1700-3300	Tree	Lachung	Timber
Larix griffithiana	Pinaceae	Barge Salla	2600-3600	Tree	Zema, Yumthang	Timber
Picea spinulosa	Pinaceae	She	2400-3000	Tree	Lachen	Timber
Tsuga dumosa	Pinaceae	Tengre Salla	2400-3000	Tree	Chhaten, Lachen, Zema, Chhoka	Timber used in house construction
Abies densa	Pinaceae	Gobre Salla	2950-4000	Tree	Yathang, Yumthang	Timber
Cryptomeria japonica	Taxodiaceae	Dhupi	1500-2500	Tree	Damthang, Ravongla	Timber
Cupressus corneyana	Cupressaceae	Tsendeng Shing	2500-3000	Tree	Rhenok	Timber for dzong construction
Thuja orientalis	Cupressaceae	Morpankhi	1600-2000	Tree	Gangtok	Timber
Juniperus recurva	Cupressaceae	Shupo Shing	2900-4200	Tree/shrub	Chhangu, Thangu	Twigs and leaves used as incensematerial
J. squamata	Cupressaceae	Shupo Shing	3200-4700	Tree	Thangu	Twigs and leaves used as incense material
J. pseudosabina	Cupressaceae	Kaalu Shupo	3500-4500	Tree/shrub	Yumthang, Zema	Wood as incense material
Podocarpus neriifolius	Podocarpaceae		900-1400	Tree	Lower Teesta valley	Timber
Taxus baccata	Taxaceae	Dhengre Salla	1800-2700	Tree	Lachung, Tholung	Used medicinally
Ephedra gerardiana	Ephedraceae	Shomlata	4000-4500	Shrub	Thangu	Plant contain ephedrine; used in treatment of asthma and cold
Gnetum montanum	Gnetaceae		270-800	Tree	Lower Teesta valley	Timber

- Enhanced capacities for more effective public services delivery to professional skills;
- Sustainable natural growth; increased life expectancy; social protection;
- Improvements to environmentally sustainable economic management especially in rural areas;
- Favorable environment for market development;
- Better plans, management and monitoring of the environment sector;
-

ocal communities contribute to and benefit from sustainable use of natural resources.

Articles

- Traditional knowledge and Conservation of Gymnosperms in North Sikkim.
- Novel conservation and policy modeling approaches for sustainable ecosystem and Environmental monitoring.
- Development of priority concerns and potential health and education interventions.

Reports (Biannually)

- Conservation Governance and Policy Monitoring of Ecologically, Economically and Evolutionary Significant Group, The Gymnosperms - A Scenario in North Sikkim Himalaya.

Workshops

- Gymnosperms, Population-Poverty-Environment Linkages in North Sikkim.
- Community Based Environmental Management in Lachen – Lachung Valley, The Impacts and Spheres of Influence of the Conservation Program.

Collaborators: Forestry, Soil conservation, Ministry of Enterprise & Employment (MEE). Tourism, Environment & Communications; Economic Planning and Development (MEPD): Population issues, Finance (MoF): Land related Revenue Collection, Information Management; Natural Resources and Energy (MNRE): local NGOs, Universities in Sikkim, BSI Sikkim.

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Looking into the Theoretical Development of Science Popularization Studies in China

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Abstract. Science popularization, or science communication, holds its ground as a favorable cultural device long since the coming out of new China, but it was not until 1980's that science popularization studies in China stepped into the stage of theoretical integration.

This paper is intended to 1) briefly review the scenarios of science communication for the public in a span of 60 years in different cultural contexts, 2) trace down the developing path of science popularization studies at theoretical level by discussing the focusing issues occurring in the period of theoretical integration, 3) summarize the basic characteristics of science popularization studies in China.

Keywords: Science popularization, Science communication, Theoretical development

Introduction

Science popularization is a historically preferable phrase in China referring to the prevailing cluster of new concepts such as science communication, PUS, scientific culture, etc. The science popularization studies in China launched somewhat late as compared to the developed countries, and there are rather big gaps in depth and width in theoretical studies. Some researches are still at the level of narration of practical facts trying to find out some regularity, while there do appear some reserches containing factors of theoretical analyses.

Division of Historical Development of Science Popularization Studies

Based on the references of divisions of science & technology history and science popularization development, the evolution of theoretical research on science popularization in China can be divided into three periods: "awareness of science popularization" period from the end of 16th century to 1949, "understanding of science popularization" period from1949 to 1978 and "theoretical integration" period from 1978 till now.

The first period witnessed the coming out of science popularization. During this period scientific knowledge of western society spread eastbound and was localized gradually by Chinese culture. It started from the idea of "Chinese culture the body, western science the limbs", then went further to the belief of "save the country with science", "scientism" and finally went to stillness in war times. The practicability and functionality of science were over emphasized in this period, while the value of scientific thoughts was not fully understood by the ordinary people. Nonetheless, it opened the door for science popularization in China.

In the second period, science popularization was carried out in the working pattern at national level. There were big steps in science popularization in China since the government provides beneficial conditions and powerful supports for the development of science and technology. Science popularization theories began to draw nutrition from the practice by summarizing successful experiences. Items concerning science popularization in science and technology policies were made and discussions about science popularization work were held intentionally in which theoretical factors can be found.

The third period is a consciously developing period of science popularization study. Influenced by the western science and technology communication theories, Chinese scholars and researchers started to learn and introduce western theories and try to merge local study with imported ones, that is, to analyze Chinese science popularization practice applying advanced western theories.

After the National Science Conference in 1978, some researchers put forward the thought of construction of "science of science popularization", that is to say, making science popularization a separate research domain.

Around 1990's, the first proceedings of science communication study were published and the theories of public understanding of science were introduced into China to the moment. Together with the rise of science and technology communication study brought along by

Communication Science, a distinctive theory system of science and technology communication in China has come into being. This system was based on both critiques of “traditional science popularization” thoughts and absorption of western theories by university scholars.

As it entered into 21st century, another hot spot appeared with the issue of *Law of the People’s Republic of China on Popularization of Science and Technology* (2002) and the *Outline of the National Scheme for Scientific Literacy* (2006). Studies on interpretation and promotion of “public scientific literacy” rooting in the measurement of which become the core subject of theory research on science popularization.

Theoretical Integration of Science Popularization: Multi-Dimensional Research Field

The science popularization in China entered into a new period after 1978. The contents, approaches and methods in science popularization study are very complicated without a common clue since there is very close connection between science popularization and science of communication, education, sociology and anthropology, etc. Discussion in this part is about the representative issues drawing the attention of most researchers in different developing periods of time with the new ones emerging but not substituting the old ones.

Attempt to construct science popularization as a separate discipline

Based on the experiences and lessons learned in science popularization practice in more than twenty years, construction of science of science popularization was proposed when science popularization began its redevelopment after 1978. Although the first monograph on science of science popularization was not published until 1989, there was already an article titled *Probing into science of science popularization* expounding what science of science popularization is in 1979, which initiated the study on how to construct the science of science popularization.

It was written in the article that, “There’s special rules in realizing speedy, correct and most effective popularization of different scientific knowledge and techniques for different objects, which has become a particular science.” Considered the differences between science popularization and other sciences, it was concluded in the article that, “The science of science popularization is a traversing science which studies the popular and common phenomena extracted from all other sciences.” Two kinds of researches were suggested to be studied, one is theoretical research, and the other is applied research. The contents of the former should be the history, position, function, motivation and cognizing discipline of science popularization, while those of the latter are the different patterns, rules and approaches of science popularization practices. The practices here include but not limited to science popularization propaganda, education, exhibitions and so on. In further discussion, science of science popularization was also defined as “a science studying and revealing the rules and corresponding dialectical relations of science popularization, and the way to grasp and apply these rules and relations for more effective science popularization.”

Inspired by *Probing into science of science popularization*, monographs such as *Introduction on Science of Science Popularization*, *Conspectus on Science of Science Popularization* and *Science of Science Popularization* were published afterwards. Some intended to construct the theoretical systems and practical patterns for modern science popularization based on the modern sociology, modern science of education and modern science of communication. Basic problems encountered in theoretical construction and development of science popularization were summarized, systematic process and main factors including backgrounds, purposes, undertakers, objects, contents, conveyers, effects were analyzed for modern science popularization.

All these books differed from each other mainly in the degree of influences they received from modern theories of public understanding of science and communication of science and technology due to different times. With no fundamental difference exists in their logics and arguments, they have the following points in common:

(1) They all try to string the practices and theories of science popularization together by a certain system, which reflects the cognition of researchers on the systematic and disciplinary characteristics of science popularization. The simple and plain understanding in the past has become multi-dimensional, leading to more

complete and integral understanding of science popularization. However, the logics supporting the system are still vague, without enough analysis and links between science popularization and the nature of science as well as popularization practices and mechanisms. Thus, these systems looked somewhat like a cabinet with lots of things stored in it, instead of a big tree with stems and branches.

(2) As the inheritance and enhancement of the science popularization study in the second period, the study of science of science popularization in these books unavoidably has the feature of macroscopic and top-down standpoint. The attempt to fit science popularization into a systematic framework continued from 1978 to 21st century, but mainly from the vision of science popularization undertakers (government or related organizations) and considered the science of science popularization “a science to study the rules of relay, popularization and pass-on of knowledge and techniques”. Even some analysis and researches went deeply into certain aspects of science popularization practice, the theoretical study in these articles could not surpass the preset boundaries due to limited standpoints.

(3) With the emphasis on absorption from Communication Science, these books were somewhat superficial in “copying” the theories of communication. Although these studies made great improvement to previous achievements, nevertheless they were of constrained vision and depth. Such science communication studies in the form of “simple combination of science communication concepts with the theory” can easily been observed in many research papers.

Reflections on and inceptions in traditional science popularization ideas

After the introduction of public understanding of science into China, some scholars considered that “science communication” should be used instead of “science popularization” because the former has a broader vision and more profound contents as compared to the latter, and fits better with the nature of science popularization at new times. There’s also another consideration saying it is not necessary to go to the extremity of completely replacing “science popularization” by “science communication” because selection of terms is less important provided that new ideas and thoughts can be included in the term being used. Lots of things could be done by expanding the original concept even under the same term. In fact, these considerations reflect that the concept embedded in the term “science popularization” has had constraints on its application, therefore new ideas should be added to it. The following three points explicitly summarizes the new ideas: (1) Science popularization should develop from one-way popularization to two-way interaction. On the one hand, scientists deliver scientific knowledge to non-specialists; on the other hand, the public participate in the creation of science, the formulation of science policies and the construction of scientific systems, and interpreting the role of science in the society together with scientists. (2) Science communication is not only a measure applied by the scientific community to reach their purpose, nor a unilateral one-way activity of the nation, but the figuration and construction of culture. (3) The science communication process is a process of convergence of science and humanities.

The proposition of rename is opposed by some other scholars for different reasons. Some take science communication as a concept with broad contents including not only science popularization and scientific news, others find that science popularization emphasizes result while the science communication emphasizes process, thus they could not replace each other since they are not equal logistically. These debates showed different understanding on the contents, purposes and positions of science popularization, and brought new contents to the concept of science popularization as time passed by.

After looking into different definitions of science popularization these yeas, we found that the contents of science popularization are basically four scientific things, i.e., scientific knowledge, scientific methods, scientific thoughts and scientific spirits. (In fact, science popularization in China for all these years put much more emphasis on popularization of scientific knowledge than the latter three.) The way of science popularization is referred more to communication but without detailed explanation (which reflects our weakness in science communication study). The target audience has always been the public, while the purposes are enhancement of economy and culture by improvements of individual’s scientific literacy. Though there lack some description of the main body of science popularization, transformation from government guidance to public participation and interaction could possibly be noticed. Big changes are the emphasis on understanding of the relations between science and society, and the requirements on public abilities to participate in public scientific affairs which showed science, society and individuals have gradually become the important subjects in science popularization studies.

In fact, there existed for a long time the debates on science popularization and science communication, which gradually lead to analyses on stages of science popularization and arguments on their models and standpoints. Professor Liu Huajie from Peking University pointed out two traditions in science communication in China: (1) science popularization; (2) science journalism. Followed the first tradition, there are three stages in science popularization: traditional science popularization, public understanding of science and science communication. Their communicative models and standpoints are shown in the table below.

Table 1. Models & standpoints of public communication of science

	Models	Standpoints
Traditional science popularization	Central broadcasting	Of Nation (or Party)
Public understanding of science	Deficit model	Of Scientific community
Reflective science communication	dialogue (or participation)	Of citizen (or humanism)
Trends	with feedback and participation	Multiple coexistence

According to Liu Huajie, the 1st model was used in planned economy times for the needs of nation and governments. It emphasized on academic authorities and scientific beliefs, paid more attention to knowledge and techniques, but less to scientific methods and processes, say nothing of social operations, limitations of science and faults of scientists. The science popularization perceptions in this model derived from the mainstream ideology and combined the science popularization practice with the need of production and construction, which resulted in a unified mechanism of science popularization under centralism. The second model is science popularization or communication with preset scientific authority and ignorance of the public. And the science popularization practice in this model targeted on the improvement of public scientific literacy as well as public support to scientific work. The third model is characterized by diversity of audience and main bodies, emphasis on public attitudes and right of expression, consideration of social justice and fair distribution, etc. In his opinion, the science communication ideas in China lie between first and second models, with a transition to the third model to some degree. The three stages and their models neither appear in sequence, nor grow upon in grades, but coexist at present with respective emphasis. The reality tells us science communication is a multi-dimensional concept in multi shapes.

The analyses of three-stage division of science popularization revealed the humanistic perspective of science communication study, answered the questions of what to communicate (first or second order/first and second order) and why communicate (people oriented), but lacked discussion on how to communicate.

The study on science communication mechanisms became important when the concept of science communication was accepted by more and more people and even brought about the expansion of the connotation of science popularization, but study in this field in China is limited to some analysis and researches on western theories.

In *Models of Public Communication of Science in the Background of Communication Theory from Europe and America* , the author concerns about the research of MPCS in Europe and America. He classifies theories about MPCS to three kinds, i.e. traditional models, alternation models and some new models in the background of media-isolation. Generally speaking, MPCS undergo a process from linear models to divergent models, and then to web models. There are many backgrounds and hypothesis in this process, which are worthy of studying. Traditional models (canonical account models and others) were put forward after the institutionalization of science. In these models, the "simplified" science knowledge is diffused to the public through the media, which is simple but of defects. The criticism comes from two ways: on one hand, psychology research proved that when the public learn about science, it's a rather active than passive process; On the other hand, some scholars find out that the boundary between science and common sense is not as clear as the traditional models said. They think that science communication is not only a kind of communication but also a part of science, and PCS is the last process of the science communication. The relations between the media, science and the public become more and more complex with the development of media. John Durant's model shows the interaction between media and the public. Web model by Bruce Lewenstein proves that the complexity of communication leads to the informational instability. In Peter Weingart's opinion, science means intermedia, and the media has replaced the monopoly station of the science.

Except for the above mentioned dissertation , there are other articles giving deep and detailed analyses of models and theories of public understanding of science. There's one paper exploring division of science communication models in terms of dissemination structure, called respectively vertical communication, diffused communication, hierarchical communication and feedback communication, etc. However, there is still short of studies on mechanisms coincide with actual situation and helpful for science popularization practice in China.

If we make a simplified summarization of the concerns of science popularization studies in this period (the real facts are much more complicated), we will concentrate on three aspects: the contents, purpose and mechanisms of communication. The communication contents (what to communicate) changed from mere "positive" scientific knowledge, which was considered self-evident, to cognition of the importance of scientific methods, thoughts and spirits, as well as doubt on the authority of science. The communication purpose (communicate for what) changed from governmental needs to the proposition of public needs. And the communication mechanisms (how to communicate) emphasized on the exploration of functional communication models, with lack of study on effective mechanisms.

Studies on public scientific literacy

Followed and accompanying the attempts to construct theoretical systems for science popularization and the reflections on traditional science popularization, many researchers show their interest in study on the promotion of public scientific literacy aroused by the survey of public scientific literacy.

Around 1990's the study on public scientific literacy in China began with the introduction of the results and systems of the survey of public scientific literacy by Jon Miller. Then seven investigations were carried out respectively in year 1992, 1994, 1996, 2003, 2005 and 2007, with the eighth one going on now in the whole country. Originally the surveys were done applying the whole set of measuring tools of Miller's from the basic theory to the methods.

After years of development, we have had our own thoughts and studies at the theoretical level based on our learning from the surveys and absorption of advanced theories of public understanding of science. These studies include both applied research directly related to and theoretical research indirectly related to the survey. For the former there are studies on the index of public scientific literacy, sampling, and weighted calculation, etc., for the latter there are analyses on concept and contents of public scientific literacy and studies on related communication theories. For example, in the doctoral dissertation *Research on Theory & Practice of Measurement of Public Scientific Literacy: Take Miller's System as a Clue*, Li Honglin establishes an analytic framework to carry out a comprehensive inquiry to theories and practices of the measurement of public scientific literacy based on multidisciplinary research perspectives and a wide range of critical attitudes of STS.

It is explained in the paper why the cognition of scientific literacy and the measurement design of Miller's system deeply reflect the implicitly underlying traditional view of science and the "deficit model" of public understanding of science, as well as how multiple models (e.g. democratic model, reflective model) and concepts (e.g. three paradigms of PUS, civic epistemology) of PUS reflect on the theoretical foundation of Miller's system and contribute to the theoretical evolution of the measurement of public scientific literacy. It is commendable that a stratified measurement structure that combines both "living science" (a new concept suggesting the importance be attached to the combination of living science, academic science and post-academic science) and Miller's system should be adopted in the measurement of Chinese public scientific literacy. No matter better or worse in rationality and feasibility of this structure, the exploring approach and studying vision of relations between public scientific literacy measurement and theoretical models are of value.

Around the issue of *Law of the People's Republic of China on Popularization of Science and Technology* in 2002 and *Outline of the National Scheme for Scientific Literacy (2006-2010-2010)* in 2006, some studying projects have been launched in order to provide theoretical basis and practical foundations for their formulation as well as further explanations for future implementation.

An example is the *Research Analects of National Scheme for Scientific Literacy* collecting 21 research reports by 11 teams around the formulation of the National Scheme. The research contents of these studies include: the connotation, structure and situation of public scientific literacy in China, factors influencing the public scientific literacy in China, the purpose and importance of promoting public scientific literacy, ways, mechanisms and environments for the enhancement of public scientific literacy, national standards of scientific literacy for Chinese public, the monitoring and assessment of projects aiming at promoting the public scientific literacy. The achievements of all these studies had their reflections in the guidance and plan of the Outline on the construction of public scientific literacy in China. For example, the public scientific literacy is expressed in the Outline as "knowing some necessary knowledge of science and technology, mastering basic methods of science, building up science thoughts, advocating science ethos and having the ability to apply them to resolve practical problems and participate in public affairs". This is summarized and refined from two reports in the Research Analects of National Scheme for Scientific Literacy. So are the purposes in each implementation stage, the schemes for different groups of people, and the setup of basic science popularization projects.

A large proportion of studies on public scientific literacy are applied research, e.g., the index study in survey of public scientific literacy, and the reliance of the Outline on theoretical study achievements. However, many studies still remain at superficial level dealing with empirical research on science popularization practice. Reasons hidden behind the problems haven't been figured out nor effective resolutions been proposed. For example, though recognized by some researchers, there are no detailed patterns, ways or measures given for the rules of "multi-participation, two-way interaction and alternate integration" which should be obeyed in the promotion of public scientific literacy.

Conclusions

The characteristics of science popularization studies in China are figured out by combing its theoretical development and analyses of typical issues. The features are summarized as follows:

(1) Science popularization studies in China is undergoing the period of accumulation and integration of theories. But the advancement develops slowly possibly due to the lack of an flexible and open system and advanced research methods.

(2) The multi-disciplinary interaction in science popularization or science communication studies is very obvious. Influences on the theoretical study of science popularization in China mainly come from public understanding of science and science of communication.

(3) There are lots of macro level studies while lacking micro level ones.

(4) Equal emphases are paid to theoretical and practical studies, but there's not many in-depth and detailed case study.

(5) The influence of traditional science popularization study patterns result in much more studies from point of view of the main body than those from the angle of target audience.

(6) The study on science popularization mechanisms need to be strengthened.

Experiences of Jana Vignana Vedika in Communication of Science and Technology Among the People in Andhra Pradesh

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Science and Technology Communication

Our Constitution prescribes Developing Scientific Temper, Humanism and Spirit of Inquiry and Reform as some of the fundamental duties of every citizen. Popularization of science and inculcation of scientific temper among the people is one of Jana Vignana Vedika's (JVV) major tasks and priority areas. Its modes of popularization of science among people include folk arts, street plays, dance, magic, sound and music and other art forms besides the usual speeches, book exhibitions, demonstrations, debates, presentations, mobile science laboratories, gauntlet challenges against baseless claims, etc. Some of the activists of JVV regularly contribute articles and science features in vernacular dailies and magazines besides participation in electronic media and AIR. JVV has developed a series of radio episodes on 'Chemistry in Daily Life' (13 episodes of 30 minute duration), 'Emergence of Modern Science' (another 13 episodes of 30 minute duration) and 'Mana Nela Mana Bhoomi, meaning Our Land and Our Earth (a 52 radio episodes of 30 minute duration, developed in connection with the International Year of Planet Earth, in 2008) and other areas of science with a collaboration of the DST's Vigyan Prasar and All India Radio. Whenever astronomical events such as eclipses, meteors, comets, occultation's, etc. occur, JVV would be the first to go to people at their habitats and make them understand the underlying principles of such phenomena lest they should attach obscurantist cause to them and continue to be eternal slaves of paranormal and superstitious belief systems. Further, during events of calamity, such as tsunami, storms and floods, accidents and other untoward situations, it gears up its human and material resources to go to the material and mental needs of the victims and the aggrieved. Fake god men, soothsayers, palmists, quacks and unscientific medical prescriptions are on the waning due to the protracted activities of JVV. It has been rated the topper in celebrating the United Nations' International Year of Physics, 2005. As a befitting culmination of the celebrations of the International Year of Physics, JVV has installed a life-size statue of Albert Einstein, the genius of the millennium and on the basis of whose scientific works was the year, 2005, declared as the International Year of Physics.

Education

With the strength of several thousands of teachers as its members, the JVV organizes teacher training to make them enjoy teaching and promotes pedagogic innovations to make learning an enjoyable activity for children. In consultation and association with teacher organizations, it holds frequently workshops to enhance the teachers' information on the latest developments in science and technology by closeting them to eminent scientists and academicians of premier institutes of higher learning. It also assesses curriculum and textbook contents and concepts and organizes children's science festivals, such as balotsavs, srijanotsavs, joyful learning, bala melas, etc, frequently on massive scales. Further, it has developed PowerPoint slideshows and software modules in several subjects of academic interest besides lecture notes and booklets. To promote quest for knowledge and bent of socio-scientific and technological awareness among school children, JVV conducts Chekumuki Science Talent Test every year for high school children. As many as 6 lakh students have participated in this test during the year, 2007. The state level chekumuki science talent test, known as Sainsu Sambaralu, is not a competition but a festive convergence of bright minds from all over the state. It is marked by the so-called, Science Carnival, in which science toys, science shows, science demonstrations are staged all along roads.

The adult literacy, neo-literacy and post-literacy programmes, JVV organized, have brought praises to JVV from many corners. The mobile science laboratories (with help of DPEP), workshops on Low-Cost and No-Cost Science Teaching Aids, activities by name Joy of Learning, Summer Camps and Winter Camps for school children and teachers, etc some of the other very acclaimed activities of JVV in the Educational front.

Health

Over the last few decades, JVV has actively been campaigning for people-oriented health policies and medicare. Led by a band of dedicated doctors and activists, the organization conducts surveys and analyzes the ground realities of health care at all levels while preparing village level health plans and cost-effective and lasting solutions. As an active partner of Jana Swasthya Abhyan (People's Health Movement), JVV has been critically examining the health policies of the governments and formulating alternative health policies while cooperating on certain areas many were baptized to JVV when there was a Prohibition in the state of Andhra Pradesh. It was the Literacy Movement, spearheaded by JVV, and one of the many short stories written by JVV for the illiterates, that sparked the Anti Arrack Movement. It has been a milestone in the successful chronology of events of Jana Vignana Vedika. JVV has been organizing workshops and conventions to impress upon the people and the polity that giving healthcare to everyone is State's responsibility as per the Alma Ata Declaration, which stated "Health for All by 2000 AD". It also conducts seminars on various issues related to health such as HIV/AIDS, PC and PNDT Act and general public health awareness. It brings into light some of the unscientific and corporate-based health policies and strives to protect the PHCs.

It vehemently fights against the misuse of medical technology for looting people's purse and against unethical practice of sex determination and organ trafficking. It holds health camps and health-awareness programmes frequently all over the state. It fights against spurious drugs, quacks and clinically unfounded medical claims. It emphasizes the need for medical research towards lasting remedies for epidemics, gross ailments, community healthcare, rural hygiene, women and child healthcare and social and preventive medical systems. It welcomes traditional methods of medical practice for scientific scrutiny and physiological causative verification so as to be mounted on unquestionable scientific disposition.

Publications

One of the major strengths of JVV is its publication wing. To promote quest for knowledge and love for science and technology among school children, the JVV has been running the largest circulated Telugu children's science monthly magazine, *Vidyarthi Chekumuki*, since 1990. In addition, it has been publishing and circulating different kinds of books on science, culture, history, education, health etc. for all levels of people. Promotion of reading habit among children is a regular and ongoing activity of JVV. It organizes book exhibitions, reading festivals and readers' clubs. Most importantly, it publishes and circulates booklets, pamphlets, science bulletins, science calendars and diaries. It has brought more than 300 titles on various socio-scientific topics and on popular science. It also runs Jana Vignanam, the JVV's organizational monthly.

Design Implementation and Performance Comparison of ZCC code and MDW code for 10Gbps Optical CDMA System

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Abstract. OCDMA is an efficient method of optical communication in which Optical codes is used at transmitter end in order to encode the data and correspondingly it is decoded at receiver's end. Every user has a specific code through which it encodes the data and thus minimizes the error rate in the system. Here a comparison between the codes ZCC and DW is done. As these codes have a correlation value of either zero or close to the ideal value. In this research, we have designed a system to incorporate both these codes separately and analyse the performance on the basis of BER and Q-factor taking a 50km of fibre and sending the data at 10Gbps. Further, the results are analysed using eye diagram and signal diagram for both the above mentioned codes and it was observed that DW code support only 16 users whereas ZCC code supports 18 users with minimum BER as e^{-9} . The codes where constructed using MATLAB and implemented in Optisystem 7.0.

Keywords: Zero cross-correlation (ZCC), Double word (DW), Optical code division multiplexing (OCDMA), Multiple access interference (MAI), Optical communication, bit error rate (BER), Quality factor (Q-factor)

Introduction

The optical CDMA systems suffer from MAIs from other simultaneous users. As the number of simultaneous users increases, the bit error rate (BER) degrades because the effect of MAIs increases. In this method, our data is being encoded through time delays representing providing the necessary chip rate for the given code. Thus, similar time delay is employed at receiver's end in order to decode the incoming signal. Optical Fibre is used as a channel for sending information and thus, this type of communication is referred as OCDMA. All the data is sent through the same frequency but every user has a unique code through which data encryption is done and this reduces MAI, thereby supporting more number of users efficiently. In OCDMA system Phase Induced Intensity Noise (PIIN) is strongly related to MAI due to overlapping of spectra from different users [1]. Thus, ZCC codes and DW are compared in terms of BER and Q-factor for same number of users. Comparison is done between the eye diagram and signal diagram in order to find out which has a minimum MAI. The result is being simulated in optisystem7.0 for 50km fibre and 10Gbps bit rate maintaining the laser frequency at 193.1THz. This paper will follow the sequence given as under:-

In Section 2.0 code construction and properties are mentioned, Section 3.0 design of the system is being discussed and results is followed in Section 4.0

Code Construction

DW CODE

The DW code has a fixed weight of two. By using a mapping technique, codes that have a larger number of weights can be developed. Modified double-weight (MDW) code is a DW code family variation that has variable weights of greater than two [1]. Here we are not using MDW code because it has a code length more than that of DW code. So in order to make our system cost efficient we choose DW code rather than MDW code.

The proposed DW family can be constructed as follows:

This code is represented by using a matrix of size UxL where; U = number of users, L = code length.

The initial (basic) matrix for U = 2 and L = 3 is given as:

$$D1=\begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

D2= $\begin{bmatrix} 0 & D1 \\ D1 & 0 \end{bmatrix}$ D2= $\begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}$

D3= $\begin{bmatrix} 0 & D2 \\ D2 & 0 \end{bmatrix}$

And likewise DW matrix is constructed.

L = $\frac{3}{2}$U when U is even

L = $\frac{3}{2}$U + $\frac{1}{2}$ when U is odd

ZCC CODE

The ZCC code is derived from family of DW codes. The key to an effective OCDMA system is the choice of efficient address codes with good or almost zero correlation properties for encoding the source. The use of ZCC code can eradicate phase induced intensity noise (PIIN) which will contribute to better BER.

The proposed ZCC family can be constructed as follows:

This code is represented by using a matrix of size UxL, where U = number of users, L = code length.

The initial (basic) matrix for U = 2 and L = 2 is given as:

C1= $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

C2= $\begin{bmatrix} 0 & C1 \\ C1 & 0 \end{bmatrix}$ C2= $\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

C3= $\begin{bmatrix} 0 & C2 \\ C2 & 0 \end{bmatrix}$

And likewise ZCC matrix is constructed.

U = 2^T; L = 2^T

Where T is the mapping process.

System Designing

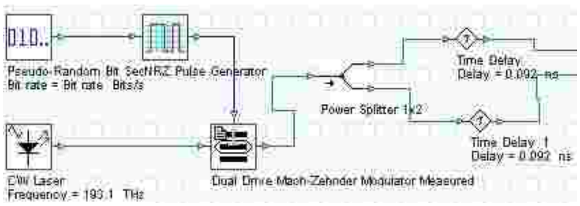

Fig 1: Transmitter circuit

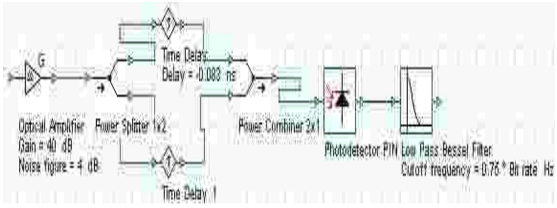

Fig 2: Receiver circuit

Bit Rate = 10Gbps

Time period of data = (1x 10^{10}) ^-1 sec = (1x10^{-10}) sec

Table 1: System Parameters

Fibre Length	50km
Bit rate	10Gbps
Source Frequency	193.1THz
Attenuation	0.2dB/km
Filter cut-off frequency	0.75*Bit rate Hz
Dark Current	5nA
Number Of Users	16

Chip Rate = $\frac{(1x10^{-10})\ sec}{2}$

Time Delay = (Chip Rate) * (Y)

Where; Y = number of zeros sent in a coded sequence before a '1'.

Here to avoid complexity of system and making it cost efficient we minimum weight.

W = 1 (ZCC), W = 2 (DW).

Results and Discussion

It is evident from Fig 3(a) and 3(b) the major effect of MAI is on DW code as its eye diagram is not as wide as that of ZCC code when the fibre length is taken to be 50km and number of users are 16, data transmitting at the rate of 10Gbps. Here heavy weight codes are not included so that the designing of the circuit should be cost effective.

Based on the analysis of BER and Q-factor it is shown in the figure that ZCC is a better code having BER as (2.935x10^{-12}) and Q-factor as (6.86066) when U=16 compared to DW with BER as (6.8984x10^{-8}) and Q-factor of 6.03669.

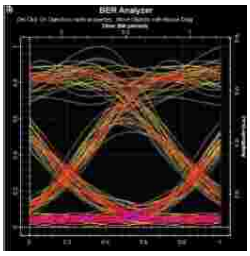

Fig 3(a):Eye diagram of DW code U= 16

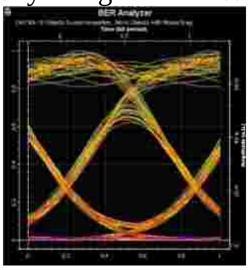

Fig 3(b): Eye diagram of ZCC code U=16

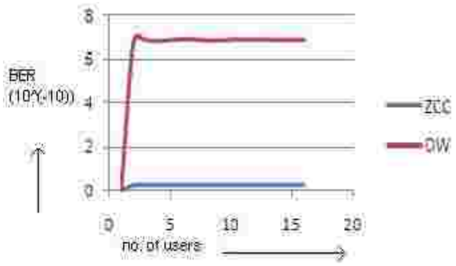

Fig 3(c): Variation of BER with increasing users

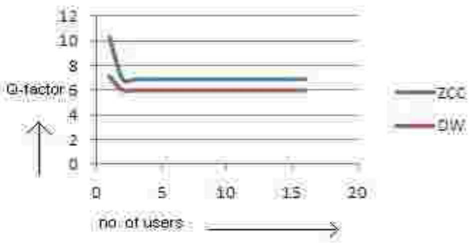

Fig 3(c): Variation of Q-factor with increasing users

It is more evident from the signal diagram that loss in signal is more in DW code as that in ZCC code and also the amplitude has fallen in DW code as a result of which the output received in DW code has more noise as compared to that of data encoded by ZCC code.

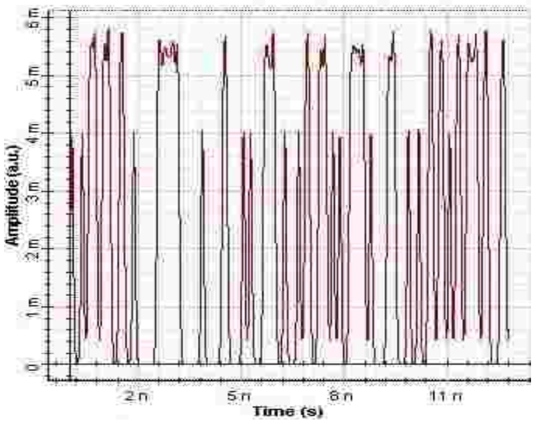

Fig: 4(a): Signal Diagram of DW code with U=16

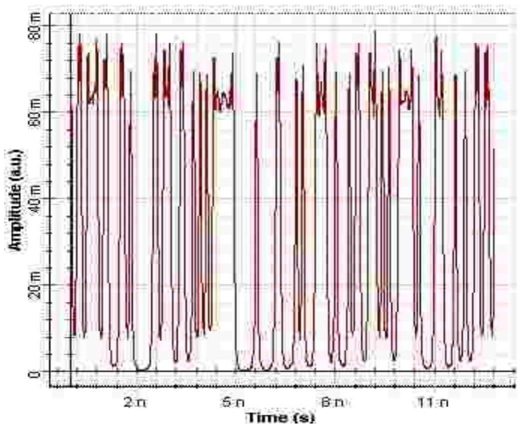

Fig: 4(B): Signal diagram of ZCC code with U=16

Conclusion

The OCDMA system so designed and implemented gives the result that ZCC code has a low BER of (2.935x10^{-12}) and high Q-factor of (6.86066) as compared to those results obtained from DW code with 10Gbps as the Bit rate and 50km as fibre length. This system supports about 16 users efficiently when DW code is applied and the users can extend to about 18 when ZCC code is used.

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The Craft of Effective Science Communication: Methods, Practices and Models

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Abstract. Science Communication is both science and art. The ability of a good science communicator depends on how efficiently and effectively s/he crafts the message of science in an artistically appealing and impressive way while retaining the scientific accuracy and authenticity in the message communicated. The proposal of this paper is to offer an insight of the various methods, practices, principles and models of effective science communication. It is proposed to discuss and critical review the strengths and limitations of the various existing models of science communication. The author will also present his techniques and practical advice as the craft of effective science communication. An intrinsic model of effective science communication is also proposed here.

Keywords: Effective science communication, Methods, Models of science communication, Intrinsic model of effective science communication

Innovative SF and Mythology Mix to Communicate S&T to Indian Masses

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Abstract. With the help of improvised cultural tableaux by judiciously blending sf and mythology during festivals like Durga Puja and Dussehra we successfully tried to attract illiterate Indian masses in order to communicate S &T perspectives and developments. Some model tableaux were as follows:

A. Tableau showing concept of Cloning: With the help of a mythological story popularly knows as 'Raktbeej and Mahishasurmardini' (Demon vis a vis a Hindu goddess Durga) and sf extrapolations on cloning we explained the process and implications of the emerging technology to illiterate people .

B. Tableau of Biotechnology: The science fictional biotech tree akin to mythological 'wishing tree' (Kalpvriksh) demonstrated the hidden potentials of biotechnology.

C. Tableau depicting water harvesting technology: Traditional techniques of rain water harvesting and its necessity as narrated in Hindu myths notably the efforts of sage Bhagirath to bring the river of gods i.e. river Ganges on earth.

D. Tsunami Tableau: Awareness and preservation of natural mangroves is the key to safety from killer waves was demonstrated with the help of many catastrophe models as described in sf stories and myth of Lord of death i.e. Yamraj.

It was established that Sf stories with a judicious mix/blend of Indian myths could be effectively used through attractive tableaux to communicate science and technology to illiterate masses that do not have access to modern means of communication. A similar approach could be replicated in other parts of the globe.

Keywords: Improvised tableau/tableaux, S&T communication, science fiction and mythology.

Introduction

India currently has the largest illiterate population of any nation on earth. Approximately 35% of world's illiterate population is Indian and based on historic patterns of literacy growth across the world, India may account for a majority of the world's illiterates by 2020.This is also the major group of people who do not have access to many modern means of knowledge communication .This poses a great challenge as how to communicate S&T effectively to these people.

Cultural tableaux are prominent crowd attractors during festivals like Durga Puja and Dussehra in India. Thousands and thousands of people throng to behold the glimpses of cultural India depicted through these tableaux. Our endeavor culminated in making beautiful and impressive tableaux which incorporated judicious blending of both cultural elements and science to easily attract lay people and then to spread the message of science spontaneously during these festivals .While science is purely an objective exercise, science communication entails the subjective /cultural perspectives also. So unless some cultural angle is not employed the mass communication of science in India shall remain largely less effective especially to illiterate people.

Impressed by imaginative and prophetic/visionary elements of Indian mythology with which even an ordinary uneducated Indian citizen is very familiar, we devised an experimental design combining mythology and sf in order to effectively communicate S&T among illiterate masses. By carefully amalgamating myth with certain breakthroughs and future possibilities in the field of biotechnology and other scientific disciplines as narrated in many sf stories we made attractive tableaux to lure the public and then inculcate amongst them the temper and wisdom of science.

Methodology

Improvised tableaux were made on themes like cloning, trans-genetic crops, water harvesting technologies, tsunami etc with the help of professional and skilled artisans and were exhibited in Puja Mandap(earmarked places for tableaux exhibition) during the festival seasons . A feedback response was obtained from the people who visited these tableaux in order to ascertain the utility and importance of this innovative endeavor for popularization of science in eastern belt of U.P. Feedback forms drafted with aim to an easy comprehension by target groups contained 10 objective type questions covering a broad range of issues related to science communication. The analyses of feed-back response were done.

Results and Discussion

Science fiction as we know today is all about strange new ideas and imagery, i.e. the same elements which also characterize mythological stories. It's for this reason that SF/F buffs are usually tempted to draw analogies between science fiction and mythology. Both science fiction and mythological imaginations at times, anticipate scientific and technological developments. It is in the very nature of sf that it usually deals with the non-existent social set ups, technology and gadgetry, etc. making the genre quite analogous to myths since the latter is also known for its depictions/descriptions of imaginary things and people.

Indian mythology as contained in Hindu scriptures abounds in imaginative ideas and human values. Carl Sagan was very impressed and inspired by these sources of ancient knowledge. He once appealed sf writers to delve deep into Indian mythology to get original sf theme ideas.

Quite interestingly there are extrapolations, imaginative themes, and descriptions of gadgets often in contemporary sf and in Indian mythology alike. For example, Puspak Viman--a special kind of aero plane which possesses a vacant seat for any last minute VIP entrant! (Remember Rendezvous With Rama by Clarke?) Sudarshan Chakra (a kind of revolving disc) and arrows used by Lord Krishna to kill enemies returned back to them just after hitting the target (the same concept as in guided missiles!). In Maya Yuddhaa (some kind of virtual war) as described in the epic Ramayan while no real damage is done all enemy soldiers get frightened and surrender owing to horrible virtual projections and imagery of all sorts! Trishanku--a celestial body which is said to have been projected into space by an ancient sage Vishwamitra. An imaginative leap of our ancestors which indicates that the sky could be conquered by man one day! This legend in Indian mythology that Trisanku is hanging in the sky between the heaven and the Earth, though regarded as incredible, has fascinated one and all since time immemorial. Now we all know about the Lagrangian points which are the five positions in an orbital configuration where a small object affected only by gravity can theoretically be stationary relative to two larger objects (such as a satellite with respect to the Earth and Moon). In 1945, Arthur Clarke also wrote in an article published in *Wireless World* that placing three geostationary satellites (Compare Trisanku!) above the equator would revolutionize global telecommunication. A mythological idea that objects can be made to appear stationary above the Earth found a place in science fiction. In 1964 the first Trisanku (!), Syncom, with the generic scientific name geostationary satellite/geosynchronous satellite was placed above a fixed longitude on the equator, which explicitly justified the power of prophetic vision inherent in Indian mythology.

It was showed for the first time that science fiction can effectively teach science to lay people who do not have access to other forms of communicative broadcasts. Peggy Kolm has referred to this innovative approach in Biology in Science Fiction and also mentioned that in the U.S. there seem to be some teachers who are using science fiction books and movies - both with good science and with bad science - to teach basic scientific concepts.

In our study sample about 70% audiences were from villages and 20% were from slums of town/city surroundings and remaining 10% from small settlements who thronged to see the S & T tableaux erected/shown during the festivals. Tableau shows in question were significant in disseminating S & T knowledge intended for the target audience and were also useful in dispelling many orthodox beliefs as was evident by the replies recorded. Majority, i.e. over 90% viewers replied that they were having many misconceptions before observing these tableaux. 70% of the target viewers were of the opinion that the tableaux were most effective form of science communication for them. Only 20% had access to broadcast media i.e. Radio, T.V., cables etc. Majority opined that folk/cultural/traditional and public relation and interpersonal contacts were more effective for them to comprehend S&T related issues.

When audience were asked that whether they were convinced to help spread further the spirit of science, their responses were affirmative and they told that were fully convinced to spread the scientific knowledge in society after seeing these tableaux. When they were asked which scientific subject was more useful in their opinion 60% told it was biological/ medical Science, 15% were in favour of agricultural sciences and equivalent number of participants voted in favour of environmental sciences. Other remaining groups constituting 5% each opined that Earth/Physical Sciences and general sciences were more useful to them.

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Effects Of Neonatal Oxygen Deprivation In The Developing Brain: Relevance of Science Communication as a Preventive Action to Minimize the Effects of Anoxia and Promote Social Inclusion

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Abstract. Public Science Understanding is crucial to deal with Neonatal oxygen deprivation and the ensuing sequelae. It is a worldwide clinical problem that causes encephalic lesions in human neonates leading to serious and lasting consequences. Therefore, finding a suitable animal model to evaluate neonatal anoxia was our goal in order to address this multidisciplinary study under controlled conditions. The model was developed and validated by various procedures. After that, experiments were performed in control, basal and anoxia groups of neonate rats. The achieved results confirmed that neonatal anoxia in rats promotes long-lasting structural and behavioral effects. Therefore, conscious of the relevance of the neonatal oxygen deprivation in health and social interactions, we organized a course in the National Congress of the Brazilian Society for the Progress of Science. In this activity, the scientific findings were discussed in relation to the need of preventive actions along with mothers and health professionals. Moreover discussions on physical rehabilitation, education, accessibility and social inclusion were also approached. The analysis of the various items explored with the participants of the course, revealed that, in general, even in the academic level, this is a not well-known subject. Therefore, it became clear that to change this picture and offer better quality of life to those who are handicapped, a multi- and interdisciplinary science communication approach, involving various segments of the society, is necessary.

Keywords: science communication, public understanding of science, accessibility, oxygen deprivation, neonatal anoxia, developing brain, social inclusion

Introduction

The structural and behavioral effects of neonatal anoxia are part of a study in our laboratory, which involves students and collaborators from different institutions.

Oxygen deprivation might be experienced in different situations, but it is specially drastic in early life, when the nervous system is developing and the effects might be amplified with outcomes that could lead to lasting damage in motor and behavioral deficits in human newborns, among them are mental retardation, cerebral palsy, epilepsy, hearing and visual deficiencies (Rogalska et al., 2006; Majeed et al., 2007; Chen et al., 2007). Statistics data report that 2-4/1000 full-term infants suffer perinatal asphyxia, however this rate reaches approximately 60% in low-weight premature newborns, configuring an important public health concern (Vannucci, 1997; Laviola et al., 2004).

Therefore, finding a suitable animal model of anoxia was our goal in order to address this multidisciplinary study under controlled conditions, and search for interrelations between particularities of the ensuing sequelae and morph-functional changes. Thus, a model of neonatal anoxia in rats was improved from the literature, which comprises a semi-hermetic system suitable for complete oxygen deprivation. The efficiency of the model was confirmed by pulse oximetric assessment of peripheral arterial oxygen saturation, arterial gasometry, observation of skin color and motor behavior and also by proteins (S100beta and Fos) immunoreactivity analyses (Takada, 2009; Takada et all. 2010). Using this model in basal, control and anoxic groups of neonate rats we could confirm that neurons and glial cells were activated in respiratory neural control areas.

Significant differences ($p<0,05$) in the proteins immunoreactivity in glial and neural cells were observed in the hippocampus of the oxygen-deprived animals in relation to control groups.

Interesting data were provided by behavioral tests performed with adult animals that suffered neonatal anoxia. Comparisons of the results of those three groups revealed that the animals of the anoxia group presented significant alterations in the following behavioral tests: spatial reference memory; working memory; sensory disturbance and anxiety and, also, acquisition of conditioned fear to sound and context (Ito, 2010).

The mentioned findings were discussed in relation to the background of the research group in science communication, physical and cognitive rehabilitation, accessibility, and social inclusion. Some doubts were raised: at what extent the academic and scientific communities are aware of the causes and mechanisms, and of the needs, of those who experienced neonatal anoxia? Which approaches would they propose to minimize the deficits and to promote physical social inclusion? Therefore, a course was elaborated and presented at the annual meeting of the National Society for the Progress of Science (SBPC- July 2010) in order to address these questions and explore, in a sample, the thoughts and involvement with the subject.

Materials and Methods

The proposed workshop was named: *Neonatal anoxia: cell and behavioral alterations and its implications in public health, education and socio-cultural inclusion.*

Its objective was to explore the comprehension of the problem by the participants, to contribute to a better scientific knowledge of the causes and mechanisms underlying the deficits that ensue neonatal anoxia, as well as to get a sense of their feelings on the situation of those who present disabilities. In addition, it was also aimed to improve the understanding, stimulate interdisciplinary research and the construction of a more fair and conscious society.

The activity was offered to 50 participants of the general community attending the meeting: teachers, graduate and undergraduate students in different academic areas. The program was scheduled for four meetings of two hours, during four days. There were selected subjects that were developed as oral presentations and discussions in groups. A workshop was developed with the attendees in which a participant would simulate visual, auditory or motor disabilities. Also, interactions between his/ her group, as caregivers, would be explored. The topics were:

Day 1: Brain structural alterations due to neonatal anoxia, etiology, animal models and their methods of research.

Day 2: Behavioral effects of neonatal anoxia in animal models and in humans.

Day 3: Relevance of the public understanding of neonatal anoxia, its implications in physical and socio-cultural inclusion and the status of educational accessibility

Day 4: Strategies of interaction between patients and caregivers; expectations and possibilities.

The multidisciplinary group of researchers involved a senior neuroscientist, a physiotherapist and physical education professionals in the doctoral level from the Post-graduation Program in Morph functional Sciences (Biomedical Science Institute), and from the Neuroscience and Behavior Post-Graduation Program (Psychology Institute), a Psychologist (master level) a Linguistic (doctoral level) and a Science Communication Post-Doc researcher.

A previous evaluation was processed to verify the participants' knowledge and also their eventual experience with someone presenting physical and/or behavioral disability. A post-course evaluation was also done, in order to assess the participants' opinion on the topics approached, by answering some questions and by grading their satisfaction from 1-10. The data were analyzed and the results expressed in percentage of the attributed grade and the number of participants that were involved.

Results

The Congress was held in Natal, a city in the northeast region of the country. Forty-three participants attended the course; they were from various states of the mentioned region. Their background ranged from physiotherapy, nursing, education and business. The business students came by mistake or accompanying a friend. Among the attendees, four had a son or daughter who suffered from neonatal anoxia and were having troubles to follow rehabilitation due to the distance of the Health Centers. Only 37% had some knowledge on the proposed subjects.

Their interest in the issues approached in the course (table I), was mainly in the consequences of neonatal anoxia, followed by characteristics of anoxia; how to take care of persons with disabilities and in the social inclusion of persons with these conditions.

Table 1 Evaluation of interest in the approached issues

Item	%	Item	%
Consequences of anoxia	33,3	Prevention of anoxia and its consequences	1,9
Characteristics of anoxia	11,7	Activities with disabled children	1,9
Area of health and quality of life	9,8	Adaptations for people with disability	1,9
How to deal with disabled people	9,8	Neonates' conditions	1,9
Inclusion of people with disabilities	9,8	Thematic importance of anoxia to society	1,9
Animal models of research	3,9	Presentation multi- interdisciplinary approach	3,9
Visual impairment	3,9	Dynamics and experience of presenters	3,9

Table 2 Evaluation of knowledge improvement by approached subject

Approached issues	Percentage of participants by attributed grade, n=43						
	3	***5***	***6***	***7***	***8***	***9***	***10***
1 Neonatal anoxia characterization	-	2,3	-	-	7,0	18,6	72,1
2.Consequences of oxygen deprivation	-	-	-	2,3	7,0	25,6	65,1
3.Socio-educational communication policies	-	9,3	-	6,3	9,4	12,5	62,5
4.Methods to evaluate cognition and behavior	-	4,6	2,2	2,3	21,0	27,9	41,9
5. Relevance of inclusion of disabled people	-	-	3,1	6,3	25,0	28,1	37,5
6. Animal models used in research	2,3	2,3	-	7,0	23,3	27,9	37,2

Table 3 Evaluation of the Developed Program and used methods

Topics	Excellent	Good	Regular	Poor
5. Lecturer’s speech	79,1	20,9	-	-
3. Workshops	74,4	23,3	2,3	-
2. Thematic content and discussions	72,1	23,3	4,7	-
1. Lecturer’s experience	69,7	27,9	2,3	-
4.Movies	39,5	58,1	2,3	-

The participants considered that the course had a relevant contribution on their comprehension of the topics addressed, attributing themselves grades ranging from 8-10, most of them were graded 10 in the various items (table II). The most relevant topic was the characterization of neonatal anoxia, followed by consequences of oxygen deprivation and socio-educational communication policies.

Most of the participants considered excellent the lecturer’s speech, program: schedule and content, and workshops (Table III). The short movies related to disabilities and lack of oxygen were rated as good and excellent.

Discussion

Although, some research reveal that certain achieved results in rats does not apply to humans (Demeter et al. 2008, Sarter, 2006, 2004), by moral and ethical principles, rats are still a good start to explore causes, consequences and strategies of some issues. The rat is the most widely used animal in experimental studies, due to their easily handling and housing conditions, for what they were chosen in this study. The stage of maturation of a newborn rat brain is comparable to that of a 24-week-old human fetus. A ten-day-old rat’s brain is nearly at the developmental stage of a newborn human brain (Nyakas et al., 1996). Therefore, the periods of analysis employed are also an important aspect to take into account when establishing research correlations between these animals and human neonates.

Structural alterations were observed in brain areas of rats which suffered neonatal anoxia, this study is now looking for a better characterization of the phenomena (Takada 2009). Structural studies and behavioral test conducted in adult rats that experienced neonatal anoxia revealed that their performance was low than the ones of the control groups. These data confirmed the presence of the damage promoted in early life with lasting effects (Takada et al, 2010 and Ito, 2010). It was observed that their performance might be greatly improved as they go through repeated learning or training procedures (Ito, 2010). These data emphasize the importance of the frequency of therapy sections to suitable rehabilitation, but the public attending the SBPC- course reported difficulties to keep the frequency of treatment of their children because the rehabilitation centers are too far from their homes and also by the current changes in the schedule for making an appointment at the national health system (SUS- Single Health System).

Brazilian Institute for Geography and Statistics (IBGE – 2009) reports that about 24.000 Brazilians present some kind of severe disability. This rate is increasing, what demonstrates either a better system to report the cases or a worse condition of public health. In spite of very good rehabilitation centers, the difficulty to set an appointment with the sufficient frequency does not help the situation.

Science communication might improve the picture; this is the hypothesis that stimulated the offer of the SBPC-course. Actually, the results confirmed that this problem is not well known by the general public, in any of its aspects: causes, mechanisms, consequences, prevention and rehabilitation. Fortunately, the attendees enjoyed the program and reported the strategies and language as suitable for their comprehension, even by those not related to health area. The students from the business field acknowledged the positive effect of this course in broadening their understanding of disabilities. They now feel enabled to structure offices considering the biodiversity of human conditions Again, the workshop as practice of hands- hearts- and minds-on constitutes a useful tool to engage and stimulate participants to work on discoveries of new approaches and solutions to the problem focused (Nogueira et al.,2007, 2008, 2009). The interactions of simulated disabled persons and their caregivers showed that this problem has to be taken into account in all its aspects; the person himself/herself with strengths and weakness, the family, the health systems and both the physicians and therapists, but also the health centers administration. Moreover, the society comprising the educational, transportation and entertaining sectors should be prepared to shelter those in need.

The major problem in special education is not only physical but mainly social (Vigotsky, 1997). The increasingly isolation of handicapped children from collective experiences and different relationships has to be changed. In Brazil, the law empowers family, school and society committed to a school for everyone. However, in spite of the therapeutic pedagogy (Manton, 2005), the practice does not come well along with the theory. The pronounced difference of these children is just one more piece of data, in the plural and biodiverse universe we live in, emphasizing the essence of human being essence, his-her humanity.

One should ask: how can science communication make difference? The answer is: at all levels! A better understanding of causes/consequences can prepare relatives to look for medical advices when suspecting of problems with the fetus; those dealing with births can be more careful in many instances. The pediatricians should be more attentive at clinical examinations to early detect or correct problems. The comprehension by the disabled person of his/her condition can also help or stimulate to look for rights at all levels, to understand and collaborate in following rehabilitations protocols. Teachers, as multipliers of knowledge, can help the socio-cultural inclusion. Meanwhile society, as a whole, better instructed, might improve quality of life in general, by considering, and not forgetting, that we all, for some period, or at some time, might be disabled to some degree.

In summary, this experience was very positive for bringing closer the course's attendees and experimental research students in the problem; respectively deprivation of oxygen and lack of science communication, with knowledge gain for both. New aspects were brought, concerning disabilities and socio-cultural inclusion, to be discussed and worked on, but the relevance of science communication was emphasized in the construction of a better quality of life and a more fair society.

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