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INDIAN JOURNAL
OF
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Indian Journal of Science Communication

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Indian Journal of Science Communication

CONTENTS

To Our Readers

Indian Journal of Science Communication invites readers' views and critical comments on any of the aspects of the journal. Suggestions for further improvement in presentation of the journal and its contents are also welcome. Selected letters would be considered for publication under the column *'Letters to the the Editor'*.

Science and communication: Can there be a meeting point!

The Two Cultures was an influential school of thought brought in by a famous British physicist and novelist C.P. Snow in the mid 20th century, first in the form of an article published by him in the New Statesman on October 6, 1956, then a talk he delivered on May 7, 1959 in the Senate House, Cambridge, and subsequently a book he published "The Two Cultures and the Scientific Revolution", leading him to bring out a follow-up in 1963 "The Two Cultures: And a Second Look: An Expanded Version of The Two Cultures and the Scientific Revolution".

It carried the basic philosophy that the intellectual life of the whole of western society was split into the titular two cultures, i.e. i) the sciences; and ii) the humanities; and that was a major hindrance to solving the world's problems. Broadly, we might extend Snow's concern to apply it in current context between sciences and communications.

The method of science could be a tool for finding a meeting point between the two. The scholars have found the method of science as a "common thread" connecting both the professions. A scientist begins with a problem or hypothesis, collects data, analyses the data, verifies it through experimentation, and then reaches to conclusion.

Similarly, a communicator or a journalist begins with a problem or newsbreak, gathers information from different sources, analyses the information from different angles, verifies it through various channels, and then files a story report based on certain facts and conclusions.

Therefore, by and large the method, process, and the way of working of a scientist and a communicator are similar; both are applying the method of science. But probably, time factor makes a big difference; scientific research is a slow and steady process, whereas communication/ journalism is comparatively a hurried and uneven process. By understanding this fact and appreciating the commonality of method of science in both the professions, both the professionals can change the situation.

Each and every occurrence in the world leaves an impression in our mind. Our mind tends to analyze these impressions in order to empower ourselves to harmonize more effectively with our surroundings and to develop and adapt ourselves to the surroundings better. Science seeks to comprehend the nature and explain the natural and physical world with scientific knowledge based on scientific facts and evidences. Application of scientific knowledge in the form of technology had changed the lives of man in early days and has been continuing to change ever since.

Over the years the development of science and technology has overshadowed all other developments but unfortunately, the development of the scientific spirit has not kept pace with the development of technology as far as the common man is concerned.

The effort to empower masses towards taking the benefits of science for the society's welfare comes to a naught when society mirrors a wide gap between scientific community and the communication community. This gap needs to be bridged. It may take long time and great effort to get rid of centuries old misbelieves and superstitions and create an environment where science is comprehensible to common man.

Innovative science communication practices can find an answer to that and therefore the 9th Indian Science Communication Congress (ISCC-2009) held at K.K. Handiq Open University, Guwahati, Assam in December 2009 focussed on the meeting point of science and communication for the benefit of society.

The approach to bridge the gap between science community and the general people, science education in the light of public understanding, various research tools and techniques for increasing scientific temperament in the common mass, various angles of science coverage by different media and the status of science communication in regional languages were the issues deliberated upon under the Focal Theme "Science Meets Communication".

In addition to the method of science and the forms of edutainment and infotainment, etc., it can be hoped that a frequent and periodical interaction of the two professions and professionals can find a widely acceptable meeting point for the growth of science communication!

- Manoj Patairiya

Science-media convergence on internet for empowering women

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Abstract

The branch of new medium is a growing avenue in the field of science and technology communication. Internet is an ever-growing and everlasting new medium, as new features are added from time to time. Internet being the latest and continuing *new* medium helps take long-unheard information, including the experience and opinions of millions of women who are now being heard, according to the researchers in *new* media. By the way, empowerment gives individuals the power or authority to do something, or to give somebody more control over their own lives or the situation they are in. In the context of women's empowerment, the term *empowerment* indicates women's political, economic and educational advancement. So, it is imperative to assess whether the Internet empowers the women who use it. If so, it is also imperative to estimate the empowering potential of Internet. If empowerment is the result of the present research, the usage of Internet can be encouraged as a tool for empowerment, thereby changing women's daily lives, their hopes, their aspirations and their future. In this context, the researcher has made an attempt to study the influence of Internet towards empowerment among the active women Internet users, as a converging new medium with audio-video and text communication facilities.

Introduction

"I see the Internet as a new medium for women to work across communities, to link up to diasporas and to share the same concerns about women's struggle for autonomy and self determination with women from other cultures", asserts Harcourt (2000, p. 693) in her study on women using the Internet. She also adds citing her own experience:

Ashamed as I am to say it, the Internet is at the hub of my life. My two daughters were breast-fed with one hand while I typed away on the other. ….my most heated arguments are often solved on the Internet…... professionally, my editing, writing, networking, sharing of information and ideas are now almost completely based on email exchanges with women and men around the world (Harcourt, 2000, p. 693).

Internet has enriched and extended life to many women and has given them the opportunity to learn and work with other women. In fact, the other women can be met only in the *glocality*, which means global and local. Women truly shape their lives only in their personal, political and global space. Of course, the personal and political impact of the Internet is not yet fully understood and felt. Harcourt goes further by describing that women's groups use Internet as a tool for empowerment, thereby changing women's daily lives, their hopes and their future (Harcourt, 2000).

Though most of the Indian women are outside the loop of this hugely promising medium of empowerment, which is always new with newly added features, the number of women who come on line is on the increase daily.

Here, it is necessary to define the term New Media. But, its definition, which may not be in a single sentence, varies with respect to the addition of new features in the due course.

Hence to the question "what is new media?" nobody can give a single answer. New media is a buzzword, used as a short hand for a volatile industry of culture and technology that includes multi media, entertainment and e-commerce. From the 1960s to the 1970s, it meant the forms, uses and implications of Information and Communication Technologies (ICTs), such as telegram, telephone, television, telex, fax, teletext, videotext, etc., (Parker, 1970; 1973; Parker & Dunn, 1972).

But, new media are constantly changing and evolving (Jones, 2004, p. 1). Indeed, all old media were new when they were introduced, and all the existing new media would become old in the future. We may end up exaggerating the impact of new technology by overestimating how much of it is actually new. (Harper, 2003, p. 31).

According to Barber (2003), it is really necessary to define what is actually meant by the term *new* here. Barber focuses on computer based digitalized media, since they represent the newest form of media. He remarks on the consequences of some key attributes of new media, including their speed, their reductive simplicity and tendency to (digital) polarization. He also remarks on their solitariness of their user interface, their bias toward images over text, their point-to-point lateral immediacy and the consequence resistance to hierarchical mediation, their partiality to raw data rather than informed knowledge, and their inclination towards audience segmentation rather than towards a single, integrated community of users or viewers. In a nutshell, it can be stated that speed, reductive simplicity, and solitude are the gifts of new media.

In Barber's days, the new media was text based, but their promise lied in pictures. Now, the Internet as a new medium offers sounds, motion-pictures, still pictures**,** etc., at a greater speed. As they grow into their most promising potential, new media are then likely to acquire all of the political defects of a pictorially based, image mongering, feeling engendering, sentiment arousing, one-on-one (one-screen-per-person) civic culture. Eveland (2003, p. 418) notes "Every new medium would merely represent a new point on the multidimensional continuum of attributes that make up all other media. In some rare cases, the introduction of a new attribute to the already available mix". Pool (1990) used the phrase *new communication technologies* as shorthand for about 25 main devices which he duly listed in his book. In fact, mainly they included personal computers, videodiscs, electronic mail, computer conferencing, communication satellites, office information systems and the like. But, recent writers have emphasized the convergence of computing and telecommunication technologies (Baldwin, McVoy & Steinfield, 1996).

An unknown author defines new media as, "The communication tools that are digitally accessible and that facilitate interpersonal, creative and cognitive processes. One has to understand new media as heterogeneous networks of communication that transform as well as confirm established boundaries, not least those of gender" ("Introduction: Gender and New Media", 2003, p. 126). By taking the growing integration of computers into account, Dertouzoz (1991, p. 63) predicts awesome results. According to his prediction, "The two giants **-** computers and networks **-** can be fused to form an infrastructure even more promising than the individual technologies".

Each new medium is defined as qualitatively different from those that came before it; or it can also be that some new feature exists in the new medium which did not exist earlier. For example, there is a similarity in the functions of a computer mouse and the television remote control, or the relationship between the concept of television *grazing* and web *surfing* (Eastmen & Newton, 1995).

In this context, any medium that adds new features to it daily from its inception and also any medium which is introduced newly can be called new medium according to the researcher.

Internet as a new medium

As per the observations of Hirsch (1996, p. 816), the meaning of *new* is crucial here. Literally, the term new connotes the following: not existing before, recently made, invented, introduced, not used before, different from the previous, already existing but not seen and experienced, recently arrived, modern, etc.,(Oxford Advanced Learners Dictionary, 2000). *New-ness* co-exists in a tension between what is seen as established (or often traditional) and new at the same time. For example, *established* forms of computing are nowadays continually perceived as being superseded by *novel* forms. So, computing is *established* and *new*

simultaneously. The distinction between old and new, which is rendered visible in the relationship between technology and domestic consumption, is simultaneously used by people as part of their own self-conceptualization (Strathern, 1996; Hirsch, 1992). A generation and a half ago, television would have had the status of a *new* technology positioned on the horizons of the consumer as a novel possibility for domestic use. But, it is no more the case now.

The key features of the Internet, like encoding of content digitally, transmission of content via a specific computer-based communication protocol, and receiving and decoding of content by a computer-based device asserts Internet as a new medium. As the Internet is the latest entry in the development of new communication media, understanding the Internet as a new medium can shed light on the social impact that it may have on the future (King, 2003).

Women with new media

By entering into the communication field, women began to move the world towards democracy by making everyone being heard and the world started listening. This phenomenon is quite new, only three or four decades old. Following the World War II, the development of a highly accessible communication technology, which was the printing press, made it possible. The then *New* medium namely the print medium made democracy a reality at that time. Likewise, for the first time in history, long-unheard information including the experience and opinions of millions of women are now being taken into account in national and international decision making through the Internet, which is the latest and the continuing *new* medium, argues Allen (1996).

Of late, this phenomenon of being heard and having one's own information taken into account is improving, which is very important for every group of the society. If so, women, who comprise 53% of the worldwide population are the major factor in the new democratization, through new media. Furthermore, women speak out authentically of their experience as members of those groups as well, because they are a half of every race, creed, colour, ethnic origin, and other minority group identity. Therefore, their effect on communication goes far beyond the addition of the essential information inherent in their female experience (Allen, 1996).

Women were not part of the first United Nations (UN) World Population Conference held in Bucharest in 1974. But, by the time, when the 1994 conference was held in Cairo, it was clear to everyone that women helped to evolve and shape the decisions.

A close look into the period between the 1960s and the 1990s shows how the change came about. It was because women were able to acquire and use communication technology which they had never previously possessed, but that actually enables millions more worldwide to take part in political decision-making. It was in short, a revolution in both communication and democracy (Allen, 1996). Only by entering into communication and media, women have been able to voice their views to the world.

Now, in the 2000s, there has been a fast growth of media and new features are added to them. Women get computer education, become *Kiosk* (Village Information Centre) operators, use mobile phones and meet each other through Internet, though geographically separated from their closer ones.

Understanding the term - empowerment

Since the aim of the research is finding out whether women Internet users have been empowered by using Internet, it is necessary here to explain the term Empowerment. The Oxford advanced learners dictionary notes (2000, p. 411), "Empowerment means giving somebody the power or authority to do something, or to give somebody more control over their own life or the situation they are in".

Schewerin (1995) establishes eight primary components of empowerment: self-esteem, self-efficacy, knowledge and skills, political awareness, social participation, political rights and responsibilities and resource. Self esteem and self efficacy, both imply how a person feels about herself, while self esteem refers to how much control a person feels that they have over their environment through an evaluation of personal capabilities. Self efficacy is the sense or conviction that one has about what is required to accomplish a particular goal (Bandura, 1989, 1982; Bandura & Chunk, 1981).

The component of knowledge and skills includes cognitive and psychological developments. The cognitive component refers to women's personal knowledge and understanding of their conditions of subordination and the causes of such conditions at both the micro and macro levels of the society.

The psychological component on the other hand would include the development of feelings that women can act upon to improve their conditions. This means formation of the belief that they can succeed in change efforts.

The political component would encompass the ability to organize and mobilize the fellow women for change. An empowerment process must encompass collective awareness and collective action.

Rappaport (1981) defines empowerment as the process by which individuals, organizations, and communications gain control and mastery over social and economic conditions, over democratic participation in their communities and over their stories (Zimmerman & Rappoport, 1988).

Foucault (1980) strongly argues that empowerment cannot be understood without first defining power. There are several kinds of relational power (Rowlands, 1998). They are: Power over, Power to, Power with and Power from within. Power over is relevant here, as it refers to those who have access to formal decision making processes (p. 13). Kabeer (1990) writes empowerment is a transformation of power between men and women. The political component would encompass the ability to organize and mobilize for change. Empowerment is a process which involves women directly in planning and implementation of projects, where only participants can develop empowerment, not the beneficiaries (Rao & Rao, 1991).

The economic component may be more difficult to demonstrate just as income generating activities, because they are risky, time-consuming, hard to sustain and difficult to implement.

"In the context of women's empowerment, the term empowerment has multiple meanings, including a varied interest in women's educational, economic and political advancement, in women getting help for personal and relationship problems, and most generally in women perceiving a range of individual and social choices as open to them and deciding among them" (Squire, 1996, p. 357).

Bunch and Frost (2000) also say that empowerment is a far-reaching process that eventuates in the redistribution of control over resources and ideology. It involves struggle over issues of financial resources, access to information dynamics of social relations, the role of culture and tradition in shaping people's lives, legal rights, and political representation and participation.

According to ICPD's (International Conference on Population and Development, 2000) definition, the features of women's empowerment are women's sense of self worth, their right to determine and have choices, their right to have access to opportunities and resources, their right to have the power to control their own lives, both within and outside the home, and their ability to influence the direction of social change to create a more just social and economic order nationally and internationally.

According to the researcher, if a woman has autonomy, independence, decision making power, social participation and is able to enjoy the fundamental rights guaranteed in the constitution of India (Part - III) to live a happier life (Manna, 1998) then she is an empowered woman. When women get the courage to experience the freedom of speech and expression and are able to assemble peacefully to form associations or unions, move freely through the territory of India, reside and settle anywhere, acquire, hold and dispose properties, practice any profession and to carry on any occupation, trade or business, they are indeed empowered.

Indicators of empowerment

Since empowerment is a complex issue with varying interpretations in different societal, cultural and national contexts, the International Seminar on Women's Education and Empowerment listed out some tentative indicators to understand it properly. They are discussed below:

At the level of the individual woman and her household scales the indicators are, participation in crucial decision-making process, extent of sharing of domestic work by men, extent to which a woman takes control of her reproductive functions and decides on family size and feeling and expression of pride and value in her work.

At the level of community and / or organizational scales, empowerment can be seen through the existence of women's organizations, allocation of funds to women and women's projects, participation of increased numbers of women leaders at village, district, provincial and national levels, involvement of women in the design, development and application of technology, contribution in community programmes, productive enterprises, politics and arts, contribution of women in non-traditional tasks, increased training programmes for women and exercising of their legal rights when necessary.

At the level of national scales, the indicators are the awareness about women's social and political rights, integration of women in the general national development plan, existence of women networks and publications, the extent to which women are officially visible and recognized and the degree to which the media take heed of women's issues.

Do all the above empowerment indicators exist in

the lives of women who use Internet? This is the main question of this research. If Internet can make all the above possible in real lives, then one can conclude that the Internet empowers women. Empowerment does not take place in vacuum. Useful factors should be facilitated to kindle empowerment. They are:

The existence of women's organizations, availability of support systems for women, availability of women-specific data and other relevant information, availability of funds, feminist leadership, networking, favourable media coverage and favourable policy climate. But, there are some factors which constrain the process of empowerment, which include heavy domestic work load, isolation of women from each other, illiteracy, traditional views that limit women's participation, lack of funds, internal strife/militarization/wars, disagreement/conflicts among women's groups, structural adjustment policies, discriminatory policy environment and negative sensational coverage of media (Rao & Rao, 2003, pp. 7-9).

Communications and empowerment

Parks (1985) says that a person's communication behaviour can produce a desired impact on others.

Wide distribution of power and opportunity can be made possible by creating open, decentralized and full communication system. This will, of course, need integrative, problem solving and practicing of challenges in an environment of trust, that recognizes and rewards people to motivate for a higher level of performance and self responsibility, thus resulting in wisdom, for coping with and learning from organizational ambiguity, inconsistency, contradiction, and paradox (Albrecht, 1988, pp. 380-385).

It is obvious from this information that communication and empowerment go together always. Because empowerment is the result of communication in terms of opinion making and subsequent shaping.

Internet represents a relatively new, but readily accessible and rapidly growing source and medium of information about women's health. A total of 48% of women health seekers say that the advice they found on the web has improved the way they take care of themselves, and 55% say that access to the Internet has improved the way they get medical and health information (Meischke, Bowen & Kuniyuki, 2001). So, studying the ways in which people use the Internet may yield options for future intervention and future research in health communications (Bowen et al., 2003).

In summary, it is learnt that earlier communication

researchers focused on five *defining qualities* of the Internet, which might offer the most fruitful study which are multimedia, hyper textuality, packet switching, synchronicity and interactivity (Newhagen & Rafaeli, 1996). But, there was no interest in doing research in Internet in the fields of women development, gender and equality due to lack of understanding of the Internet as a powerful tool of communication in achieving the above.

Significantly, the studies pertaining to empowerment of women through Internet can yield the benefits like giving future guidance to policy makers, Non Governmental Organizations and Governments to design and implement plans for empowering women through the Internet, which are of social and national interests. Among them, the aspect of empowerment of women is vital, as it is necessary to study the existing status of Internet with reference to women's empowerment in our country.

In this connection, the objectives of the present research are framed. The outcome of this research will be useful to the individuals, society and nation towards bringing empowerment to women.

Objectives

Finding out how Internet technologies empower women is the aim of this research. In this connection, the survey method is adopted to collect research data for investigation. The expected outcome shall be the generation of qualitative and quantitative data to complement the concept of empowerment through Internet. The possible research questions are:

- Women from which age group, have experienced the empowering influence of the Internet more?

- Women from which profession, do experience the empowering potential of Internet more?

- Women with what kind qualifications, have experienced the empowering influence of Internet more than the others?

- What are the Internet habits that play remarkable roles in empowering women?

- How does the Internet help women in improving their self esteem, self efficacy, knowledge, skills and the other components of empowerment?

- How do the married and unmarried women experience the empowering potential of Internet usage?

- How does the Internet play the role of a mass medium in giving education, entertainment and information to empower women?

- How are the women able to balance between their unpaid domestic works and their professions which give them earning, with the help of Internet?

- How does the place from where they access Internet, influence the empowering process?

An attempt is made extensively in this research to find out all possible replies to the research questions of the current concern.

Women empowerment is closely associated with Internet, as a communication tool which once served as a group medium, but now a mass medium. This research tries to assess the influence of Internet as an effective tool, on women users in empowering them. This type of research can be used to establish and maintain Internet:

- As a system that is balanced, decentralized, participatory and creative in nature despite the monopoly by men.

- As an environment where many empowerment possibilities become more successful.

- As an easy-to-use and extended tool to the poor rural women and children.

The other expected benefits of this kind of research are:

- To help frame methodologies of participation and use at the group and individual level, by understanding the context of empowerment on the Internet and in people's lives in general.

- To extend technological innovation for self-help in communities for communication, cooperation and happiness.

The data generated from this study will help the academicians, policy makers, NGOs and Governments to plan and implement schemes which will take the Internet technology to the life of every woman who needs empowerment.

Methodology

Case study method is adopted for this research. Eight active internet using women were identified and watched over for a period of one year. The empowering changes noticed on them have been recorded. The changes felt by them which were shared as testimonies

have been noted.

Observations

To measure the process of empowerment through Internet, the researcher developed a list of 44 indicators drawn from a variety of definitions provided by the scholars and pooled them together. The findings suggest that a majority of the respondents agree that they have experienced such indicators of empowerment after they began to use the Internet. Such indicators are categorized at personal, family, economical, social and political levels

Case study: 1

Jebamalar is a 30 year old woman with an MBA degree and specialization in Human resource Development is working in a Non Governmental Organization in Chennai. When she got married she drew only Rs.4,000/- per month as salary. Her husband, a M.Sc. holder in Computer Science was working in a small company as project leader. Though he is talented and hardworking he was able to get only Rs.5,000/- as monthly pay. This money was not sufficient to meet all their need in the Metro. As a strong person in Internet use, *Jebamalar* continuously motivated her husband to register his resume in an online consultancy. At last her husband agreed and registered his name in an online consultancy. Within a week he got a job in World Bank with a good salary. Since he already did a project for City Bank, the World Bank which was searching for a person with experience in soft wares for banking immediately gave him an appointment. Mean while *Jebamalar* also got a good position in an NGO called Intermission through email. This incident is a proof for the empowering potential of the empowered women, who have been also leading others, including men to experience empowerment through Internet.

Case study: 2

Uma Devi, a Ph.D holder in Physics was a research scholar in Madurai Kamaraj University, Madurai from 1999 to 2002. She was doing Ph.D in Laser Physics. She hailed from a coastal village *Uvari* situated in the coastal line spreads from *Tuticorin* to *Kanyakumari*. She was not fluent in English and also very timid and afraid to speak to any one. She was very much afraid of her Principal investigator and never went for discussion with him. She did not know what her next step in research was, after the literature review. She

was under pressure to write research papers for publications. She could not subscribe for all the journals in Physics. At that time another women who had been working on the same field motivated her to try for journals and foreign experts in the same field through Internet. When she tried, she found so many research journals and experts for her work from the virtual community. She met a person Mr. Francis Vanelle, from France who is also working in the same field through Internet. He asked her to do the research in collaboration with him where the sample chemical would be sent to her free of cost from Mr. Vanelle for which in turn she has to do the experiment and the research paper which would arise from her experiment would have both of their names as authors. In this way she has published more than twenty papers and got the Ph.D degree. Now she is a principal investigator, working in a University which is established exclusively for women in Tamil Nadu and leading so many women towards empowerment. She also won the Women Scientist Scheme from the Department of Science and Technology of the Government of India.

Case study: 3

Nagajothi is an MCA holder hailed from a village *Ratchanyapuram* from Madurai district. She lost her father during her childhood. She had her school education with the financial assistance from an organization called Compassion for India. With her mother's small earning she and her sister managed their life. After her under graduation she joined Master of Computer Applications for post graduation. She failed in sixteen papers when she entered her final semester. Since her health did not allow her to do her practical works and write her examination in the air conditioned laboratory, she failed in many subjects. With strong commitment and dedication she cleared all her papers when she completed the course, that is, by her sixth semester. Since she did not pass the papers regularly in every semester she was not selected in the campus interviews conducted by leading software companies. Her friends motivated her to register in online consultancies and she won the race at last by getting a job in ICICI systems. Now, she gets Rs.16,000 as salary which supports her mother and her elder sister.

Case study: 4

Ivy Primrose is a 36 year old mother and gave birth to her second son in August 2007. This child was born with four deficiencies in his body for which their family

child specialist did not have the confidence to treat, because he never encountered such cases in his professional life, though he knows how to treat. But the equipments and facilities were not available in the near by city *Tuticorin* or any other places in Tamil Nadu. Moreover there was nobody to lead her for the next step. She tried for guidance by mentioning the disease through different search engines. At last she found that an international organization called Smile Train visits India twice a year to give free treatment to such cases from India. They have collaboration with some reputed hospitals in India. When they came to *Tirunelveli* in September 2007 they saw the boy and fixed 10th June 2008 as the date for operation and gave the guidance to keep the child safely till the date of operation. Unless there is Internet and also the search engines in the web help them, the whole family would have experienced a tough time.

Case study: 5

GuruKripa is a twenty three year old woman doing her post graduation in Communication and Journalism. Since she knows English, Hindi, French and Tamil she got an opportunity to be a content editor for www.indiainfo.com. She is able to earn Rs.5,000/- to Rs.6,000/- per month. She has been able to save around Rs.70,000 for her future. While writing the content and also editing the content she gets opportunity to browse through many books and sites through the Internet. She gets good communication skill in writing. She has also worked for a movie portal called *Gallatta.com*. This job helped her to earn more, learn more and helped her to be economically independent. When her father hesitated to pay the fee for her final semester, she was able to face the situation boldly since she had money in her bank account to continue her studies.

Case study: 6

Jeyanthi is a thirty four year old lady hailed from a village called *Pathinettangudi*. She is working as the *Kiosk* (Village Information Centre) operator in *Therkutheru*, (South Street), *Meloor* (Western Village) run by DHAN foundation. She was able to complete only her Higher Secondary school and she could not go for higher studies. She got married and since she does not have kids, she underwent severe mental abuse from her husband's family members before she joined this job. She joined as one of the members in the self-help group called *Kalanjium* which encourages microfinance scheme among the village women. She

was called to be the operator of the *Kiosk* by the same foundation and was given training on Internet. She underwent training not only on Internet, but also in other hardwares and softwares. She has been in that position for the past five years. She is getting Rs.1,500/- per month which is enough for her to take care of herself.

Case study: 7

Vengadabhuvaneswari is a nineteen year old women hailed from *Therkutheru* (South Street), *Meloor* (Western Village). She has one brother and a sister. She could not continue her studies after Higher Secondary. She was at her home after her school days and felt frustrated by sitting idle. She joined in *Thagavalagam* Community College run by DHAN foundation and gained fundamental computer knowledge and learns Internet skills. Now, she is working in TVS company and able to get Rs.1500/- per month. Her salary helps her father and mother to overcome the financial problems to a bit at least. She says,

"I am able to contact my friends, class mates and coworkers through Internet. I also help the uneducated people to contact their sons who are working in Gulf as labourers through Internet. When the uneducated village parents see their sons' and daughters' faces who are abroad on the computer monitor they feel exited and come to me again and again for such helps and give me respect and recognition".

Case study: 8

Rathika is a twenty three year old women hailed from *Arasappanpatti* who could not continue her education after 10th standard. When she was six year old she lost her father. Her mother is a daily wage worker. Only with her earning she ran the family and helped her two daughters to have high school education. At that time in *Arasappanpatti*, a village information centre was started. The kiosk operator *Astalakshimi* invited *Rathika* to join ICT courses. In the beginning her mother did not show much interest in sending her. But when she saw the other girls, she allowed *Rathika* to join. In addition to Internet she learnt typing and computer assembling. She assembled fifteen computers and earned money. She became the *Kiosk* operator with her friends *Pakialakshmi, Lakshmi* and *Thavamani*. Those three friends got married and left the centre in her hands. Then she was transferred to another village information centre situated in *Panangadi* for eight

months. Then she was transferred to *Thiruvathavoor*. By the experiences she got through running these centres, she improved her communication skill and managerial skills. She helped the rural women to get information from the Internet. Whenever the Tamil nadu government announces the public examination results the rural children with their parents rush to these centres to see the marks. The regional television channel *Podhigai* interviewed her once for her contribution to the rural. The weekly supplementary of the vernacular daily *Dhinamalar* and the English daily The Hindu published an article on her contribution. Two documentaries were taken about the activities of the centre which is under her control. She got several prices for her service. She gained respect and enjoys recognition among the village people from *Thiruvathavoor*.

The findings from the data analysis and the experiences of the case studies suggest that the Internet has the potential to influence and empower the women who use it for empowerment.

Discussion

In case study (1), it is found that *Jebamalar* and her husband have been motivated to use Internet to get a job through online consultancies. As a result, they have been economically empowered. It is noticed that the following indicators of empowerment have been inculcated through Internet.

- Enhancement of skills, knowledge, and access to information
- Acquirement of self esteem, self efficacy and self confidence
- End of information isolation
- Dissemination of indigenous knowledge
- Improvement of self image
- Moving into non-traditional roles and taking decisions about herself
- Making facilities and resources available and accessible
- Ability to gain access and control over own labour and income
- End of information isolation
- Bridging up geographic separation
- Improvement of planning and thinking skills
- Acquiring skill for income generation

- Being a good women leader
- Distribution of power in interpersonal relationships
- Acquiring, providing and bestowing the resources and the means
- Ability to have access and control over such means
- Ability to direct and control her own life
- Gaining autonomy
- Moving from an extreme state of absolute lack of power to having absolute power
- Creation of different understanding of gender relations
- Destruction of old beliefs that structure powerful gender ideologies
- Development of feelings to act upon to improve existing conditions
- Having choices
- Enabling to decide where the income earned to be channeled
- Being professionally updated

In case study (2), it is found that *Umadevi*, who was a research scholar, got hold on her research through Internet. In fact, she was very timid, poor in communication, weak in self confidence, not fluent in English, unable to take the next step till she knew how to use Internet. But after she began to use the Internet, she added the following indicators of empowerment to her life.

- Enhancement of skills, knowledge, and access to information
- Acquirement of critical awareness of herself as a woman
- Acquirement of self esteem, self efficacy and self confidence
- End of information isolation as a woman and acquiring voice
- Networking with other women for social and political advocacy
- Dissemination of knowledge
- Improvement of self image
- Opportunities in higher education
- Moving into non-traditional roles and taking decisions about herself

- Making facilities and resources available and accessible
- Bridging up geographic separation
- Improvement of planning and thinking skills
- Availability of lessons
- Being a good women leader
- Distribution of power in interpersonal relationships
- Acquiring, providing and bestowing the resources and the means
- Enabling to have access and control over such means
- Enabling to direct and control own life
- Gaining autonomy
- Moving from an extreme state of lack of power to having absolute power
- Creation of different understanding of gender relations
- Development of feelings to act upon to improve existing condition
- Involvement in production activity that allows some degree of autonomy
- Attaining social transformation
- Having choices and being professionally updated

In case study (3), *Nagajothi* got a job through online consultancy after using the Internet. The following indicators of empowerment are found in her.

- Enhancement of skills, knowledge, and access to information
- Acquirement of self esteem, self efficacy and self confidence
- End of information isolation
- Dissemination of indigenous knowledge
- Improvement of self image
- Moving into non-traditional roles and taking decisions about herself
- Making facilities and resources available and accessible
- Ability to gain access and control over own labour and income
- End of information isolation
- Bridging up geographic separation

- Improvement of planning and thinking skills
- Acquiring skill for income generation
- Being a good women leader
- Distribution of power in interpersonal relationships
- Acquiring, providing and bestowing the resources and the means
- Ability to have access and control over such means
- Ability to direct and control her own life
- Gaining autonomy
- Moving from extreme state of lack of power to having absolute power
- Creation of different understanding of gender relations
- Destruction of old beliefs that structure powerful gender ideologies
- Development of feelings to act upon to improve existing conditions
- Having choices
- Enabling to decide where the income earned to be channeled to
- Being professionally updated

In case study (4), where Ivy Primrose, a mother of a new born kid, used the Internet to find out the right medical treatment and its availability in India, the sponsoring organization for the treatment and the hospital where it is available for him. It is found that she acquired the following indicators of empowerment through the Internet.

- Access to information
- End of information isolation
- Bridging up of geographic separation
- Availability of lessons on health and nutrition
- Being a good women leader
- Distribution of power in interpersonal relationships
- Acquiring, providing and bestowing the resources and the means
- Improvement of planning and thinking skills
- Availability of lessons on health and nutrition
- Development of feelings to act upon to improve existing condition
- Taking control of reproductive functions and deciding family size

- Sharing domestic work with women
- Moving from an extreme state of lack of power to having absolute power
- Creation of different understanding of gender relations
- Destruction of old beliefs that structure powerful gender ideologies

In case study (5), *Gurukripa*, a Post Graduate student was able to get financial support through Internet for completion of her studies. The following indicators were added up in her life after getting in touch with Internet.

- Enhancement of skills, knowledge, and access to information
- Challenging instances of abuse of power
- Acquirement of critical awareness on herself as women
- Acquirement of self esteem, self efficacy and self confidence
- End of information isolation as a woman and acquiring voice
- Dissemination of indigenous knowledge
- Improvement of self image and social image
- Visible contribution to the society
- Opportunity for education
- Moving into non-traditional roles and taking decisions about herself
- Making facilities and resources available and accessible
- End of information isolation
- Bridging up geographic separation
- Improvement of planning and thinking skills
- Acquiring skill for income generation
- Distribution of power in interpersonal relationships
- Acquiring, providing and bestowing the resources and the means
- Enabling to have access and control over such means
- Enabling to direct and control her own life
- Gaining autonomy
- Moving from an extreme state of absolute lack of power to having absolute power

- Creation of different understanding of gender relations
- Destruction of old beliefs that structure powerful gender ideologies
- Development of feelings to act upon to improve condition
- Involvement in production activity that allows some degree of autonomy
- Having choices
- Enabling to decide where the income earned to be channeled

In case studies (6), (7) and (8), it is noticed that the rural women namely *Jeyanthi, Vengadabhuvaneswari* and *Rathika* got the opportunity to work in village information centres (*Kiosks*) with computer and Internet facilities. Almost all the indicators of empowerment are found in their lives after their exposure to Internet.

- Enhancement of skills, knowledge, and access to information
- Strengthening of ability to combat negative portrayals of women internationally
- Challenging instances of abuse of power
- Acquiring of critical awareness of themselves as women
- Acquiring self esteem, self efficacy and self confidence
- End of information isolation as a woman and acquiring voice
- Networking with other women for social and political advocacy
- Participation in political process and knowing political rights and responsibilities
- Improvement of access to Government and its services
- Education
- Dissemination of indigenous knowledge
- Improvement of self image and social image
- Visible contribution to the society
- Opportunities for education
- Moving into non-traditional roles and taking decisions about themselves

- Making facilities and resources available and accessible
- Ability to gain access and control over means of production, property and other resources
- Ability to gain access and control over own labour, income, body and sexuality
- End of information isolation
- Bridging up of geographic separation
- Improvement of planning and thinking skills
- Availability of lessons on health and nutrition
- Elimination of illiteracy
- Raising awareness of civil rights
- Acquiring skill for income generation
- Participation in community and society
- Being a good women leader
- Distribution of power in interpersonal relationships
- Acquiring, providing and bestowing the resources and the means
- Ability to have access and control over such means
- Ability to direct and control my own life
- Gaining autonomy
- Moving from an extreme state of lack of power to having absolute power
- Creation of different understanding of gender relations
- Destruction of old beliefs that structure powerful gender ideologies
- Development of feelings to act upon to improve existing conditions
- Involvement in production activity that allows some degrees of autonomy
- Attaining social transformation
- Having choices
- Articulation of collective voice and collective strength
- Taking control of reproductive functions and deciding family size
- Sharing domestic work with men
- Ability to decide where the income earned to be channeled to
- Being professionally updated

Analysis

Personal indicators

The findings show that the studied women agrees that the Internet enhances knowledge, skills and access to information. In fact, the cultural, religious, social and humanly constructed negative values portray woman as possession of man, object of sex and glamour, and domestic worker. But majority of the women agree that Internet has strengthened their ability to combat such negative portrayals and to get the attention of the decision makers and women activists.

In all cultures women undergo severe abuse of power at home and at the places where they work from the opposite sex. There are many online help lines to help them fight against such abuse. The findings from the research appear to yield that a good majority of the respondents agree that Internet helps them challenge such instances.

The results also show that Internet helps women acquire a critical self-awareness of their own beings. Results from the previous studies also show that empowerment through Internet entails the development of creativity (Rehm, 1989; 1993), personal voice (Giroux, 1988), and other qualities related to the active construction of one's own experience and social context. The Internet can provide ordinary families with new opportunities to become what Freire (1985) calls the 'subjects' of their own lives rather than 'objects' used by others. As a tool for 'creative play', the Internet can become an important venue to resist entrenched and oppressive ways of thinking (Stivale, 1997). The Internet can potentially nourish imaginations and deepen emotional commitment to visionary ideas (Garmer & Firestone, 1996). Individuals and families can join discussion groups around social issues, publish their own work, or inform others about home-based businesses and grassroots' action groups (Garmer & Firestone, 1996). Our imagination can thus guide our technology to generate something that makes the world closer to our heart's desire (Egan, 1992, p. 166).

The research also shows that Internet gives them self-efficacy, self esteem and self-confidence. Due to the feminine qualities cast on them and the secondary treatment they get in the families, and the socially, religiously and culturally constructed negative values might have forced women to have a very low opinion about them. Self-esteem improves as a result of enhanced self-confidence through the skills and knowledge gained through Internet. Most of the time women underestimate their ability. Their family-related workload may not allow them to understand their own capabilities. But Internet helps them not only to identify their own abilities but also to improve them.

The findings of this research show that majority of the respondents agree that Internet educates them. In fact, education is a broad term, which ranges from basic literacy to higher education. Internet helps women to have basic literacy in other languages, go for higher education and access such information without expecting the help of the men folk. It is not only due to the availability of online tuitions for basic literacy and school education through outsourcing facilities, but also the availability of higher education through web sites. The findings of this research also reveal that majority of the respondents agree that Internet helps them to disseminate indigenous knowledge. Women from rural areas, who are trained by NGOs in Internet, are able to pass on basic tips on embroidering, tailoring and cooking through their near by *kiosk* (Village Information Centre) users.

The findings from the present research show that Internet improves personal and social images of women to a good majority. Perhaps accessing Internet and passing on the information to the family members and friends contribute in this direction.

By using all the facilities and resources available through Internet women may get the personal satisfaction as well as social respect and recognition, when they are able to clear the doubts of information seekers and help them find the needed information. It is also found that Internet makes all facilities and resources available and accessible. If empowerment is enhanced with more autonomy and self-direction (Brown, 1993; Baldwin, 1990), the Internet may become a valuable tool of empowerment for individuals, families and communities.

A woman can feel the empowerment process only when she is allowed to execute her thoughts into actions. The research findings show that Internet helps women to do the same in a safe and autonomous way. As ironic and contradictory as it may appear, another feature to the Internet that is pleasurable and appealing to women is the degree of safety that is provided to women. The women who feel intimidated about public speaking may feel more comfortable during speaking online. Some women may feel a relatively safer participation by using mediated communication through Internet, since it offers anonymity and distance. Writing out thoughts and arguments and posting them to a mailing group or Usenet discussion may be less threatening than speaking out to a public audience. This belief in anonymity and distance may also further

explain why women feel safe using the Internet to explore their sexual identities without having to initially confront real world biphobias. Internet gives women the opportunity to create their own new identities and to play with these. There is pleasure experienced in having control over one's identity. Control can be linked to the safety that women can feel in creating 'women only' Internet locales. Women can also discuss controversial or uncomfortable real world issues in a safe place that is under their control, where time can be spent fruitfully discussing the issues from different stand points of women. Ultimately, women may be empowered by the Internet, because it makes claims to make absent visible cues pertaining to social and power status like age, race and sex (Lillie, 2005).

The present research shows that Internet helps women to be autonomous by helping them direct and control their own lives without the intervention of the 'super power' men folks. Further findings show that Internet provides good exposure to women and helps them develop feelings that they can act upon to improve their conditions. Though the Internet differs from other technologies in its potential to transform our lives (Poole, 1997, p. 211), the options available in the Internet to individuals gives an unprecedented autonomy to meet their unique wants, needs and choices (Elkind, 1994). Never before has one single technology enabled women to shop, go to the movies, get up-to-the-minute news, make and enjoy friendships, engage in discussions about issues, conduct research in libraries, and gather a wide range of information on any interest or need, without leaving home.

Social indicators

The research findings appear to yield that Internet helps women overcome information isolation and gives them international voice. There are a number of online communities, where women can be active. In the real world, Community may be understood as a body of people living in the same locality, who have a sense of identity and belonging. To contextualize this idea in the virtual world, it may be necessary to understand community, as a set up where women can participate actively instead of merely existing. It is to exist together with other women in a shared virtual space, which parallels a community. In such a context, Internet ends women's isolation and gives them a voice. But this contradicts with the findings of Hlebec, Manfreda and Vehovar (2006), which show that the Internet has a relatively limited impact on social relationships, and the users have slightly larger social networks only in

certain socially de-privileged segments like the divorced and the less educated.

The present research shows that Internet helps women to make visible contribution to the society. Most of the women may not be able to contribute any thing to the society through media, though they have talents. But in Internet, they may create their own individual and corporate web sites, write to 'blogs' and online journals and launch their creations in the international networks. In that way, Internet makes women's contribution to the society visible.

The findings from the research indicate that Internet helps the women respondents of this study not only to escape from information isolation but also to overcome geographical barriers. The social and cultural constraints may not allow women to move freely to collect information. In fact, women are isolated from the remaining world, and experience information isolation. In such a situation, Internet helps them to escape from such alienation and overcome geographical barriers.

A woman can experience social empowerment only when she gets opportunity to participate in the community and society. The present findings show that Internet helps them to have such participation.

The findings arising from the research indicate that women are able to acquire leadership qualities with the help of Internet. When a woman tries to search for information for others on the site and manages to find it, she may be approached for such helps again and again. When a woman is able to pass on the information that she gets from the Internet, she is able to become an opinion leader and she can motivate others towards empowerment. In rural village information centres, called *kiosks,* the operating women are able to be opinion leaders by helping others know information regarding the various schemes announced by Central and State Governments and the funding agencies.

To make empowerment possible to everyone, power should be distributed equally in interpersonal relationship. In virtual interpersonal relationships, there may be no fight for power. No unfair competition for positions occurs, since there is no face to face communication. In this communication, everyone can enjoy equal rights and respect. Majority of the respondents agree that Internet helps them to have a sense of achievement. A democratic society grows when each individual begins "constructing one's voice as part of a wider project of possibility and empowerment" (Giroux, 1988, p. 64). Dialogue within an engaged community has the potential to deepen the levels of mutual understanding about information, draw

individuals into more active social roles, and generate creative possibilities for action (Baldwin, 1996; Helgesen, 1995; McLaren, 1991). Each person's voice is valuable and essential for the 'critical diversity' that is needed to raise important questions, notice oppressive power relations, critique social conditions, and reach new levels of consensus and understanding (McLaren, 1991; Vaines, 1993).

Internet creates a different understanding of gender relations and destroys the old beliefs that structure powerful gender ideologies, as understood from the findings of the study. The traditional social values have created an environment where man is superior and woman is created inferior to serve man. But Internet creates a different understanding of gender. In the virtual world, women need not face such values and need not worry about the customs and habits. They can freely express their values, ideas and opinions. Nobody can dominate on the basis of gender. This may be the reason for the creation of different understanding of gender and the destruction of old beliefs that form powerful gender ideologies.

This research also indicates that, for a good majority of the respondents, Internet helps in social transformation. Only by transforming the society in favour of women, social empowerment can be attained. Whenever a woman faces problems, voices are raised at the international level by mass emails to higher officials and international leaders to focus the attention of the world towards such issues. Women can articulate collective voice and collective strength only by making their voice to be heard in the virtual world. As per the findings of this research, to a good majority of women, Internet helps for such articulation.

Political indicators

The findings show that, to a good majority, Internet is a tool for networking women for social and political advocacy. Since the Internet breaks information isolation, it helps women to network with other women for social and political advocacy. Women may interact with other women from foreign countries on same interests and issues. Internet may help them discuss important issues and take the necessary steps internationally.

In countries ruled by fundamentalists, women are under unnecessary restrictions. In many countries, the punishments to women for committing crimes are more severe than those to men. Such atrocities may be brought out by web sites, which are exclusively for women. Women may link their place-based defense of

communities in ways that are challenging and changing public institutional spaces. The boundaries between private and public in place based politics around the body; the community as well as public arena may be altered. For example, violence and sexual harassment against women in families, places where they work and society may be openly discussed on the web. Women who are at home for work may link with others for supports in terms of managing children and other domestic pressures. Women in high-tech factories in Asia organize across north-south lines with the international support of NGOs on health and work conditions including women's special needs, for example on night shifts. In addition, using the UN process, women may bring local concerns to the forefront of the international agenda through Internet, analyze women's needs in each region and connect to political leaders who are willing to support a women's agenda internationally, at times in deviance of fundamentalist and anti women positions at home, supports Harcourt (2000).

The research findings also indicate that Internet helps a good majority to participate in the political process and to know their political rights and responsibilities. Few of the respondents were able to know their serial number, booth number, and the location of the nearest voting booth during the Assembly election of Tamil Nadu and the Parliamentary election of the nation. One of the respondents Jebamalar, who migrated from Tirunelveli to Chennai for job, did not find her name in the voters' list for which she had done the needful when the concerned officials visited her house for preparing the voters' list in Chennai. Till the day before the Tamil Nadu assembly elections, she could neither locate her name in the voters' list nor the voting booth allotted for their area. She wrote to Mr. Naresh Gupta, the then Chief Election Commissioner of Tamil Nadu through email explaining this problem. Immediately, the election commission office replied to her email and gave the serial number of her name in the voters' list and also the allotted polling booth. The next day she went to the polling booth and fulfilled her political responsibility without any difficulty. Already Polat (2005) explored the relationship between the Internet and political participation by examining three different facets of the Internet: the Internet as an information source, as a communication medium and as a virtual public sphere. Polat (2005) argues that these facets of the Internet may affect levels and styles of political participation and hence are of interest for political scientists. Polat (2005) also emphasizes the relevance

of established theories of participation within political science in evaluating the potential role of Internet for affecting levels and styles of political participation. Tolbert and McNeal (2003) also emphasize that access to Internet and online election news significantly increased the probability of voting by an average of 12 percent and 7.5 percent respectively in the 2000 election in the US. The mobilizing potential of the Internet in 2000 was also associated with the people's increased participation beyond voting.

In India, the central Government as well as the state Government have their own web sites and links to different services, departments and ministries. The findings from the study show that women are able to access such sites and improve their contact with the Government and its services.

The social, cultural, religious and traditional roles of women may not allow them to know their civil rights and the constitutional provisions. But as understood from the findings of this research Internet raises their awareness of civil rights. The legal provisions and privileges guaranteed in the Indian constitution are made known through Internet. All the departments of the Government of Tamil Nadu have their own websites. The women and child welfare departments of the State and the Central Government also have their own websites. The scholarship announced for 'one child - one girl' families by the Central Government became very popular through Internet. Number of women have been benefited by this, especially to complete their post graduation.

Indicators at the family

Findings arising from this research show that Internet helps majority of the women to move away from traditional roles into nontraditional roles and to take decisions about themselves. Women have to play the roles of mothers to their kids, wives to their husbands, daughters to their parents and sisters to their brothers. All these facets have the traditional roles, which force women to be submissive, passive, glamorous and an object of sex. But when they become informative through Internet, their interests and concentrations change, and in-turn, they become information passers. The findings also suggest that Internet helps women to take decisions about their life on their own. Traditionally, they were never allowed to take decisions independently.

The findings from the research also indicate that, to a good majority of the respondents, Internet gives the ability to have control over their own labour, income, bodies and sexuality. When a woman becomes economically independent and the family members depend on her for money, she may automatically gain the influence to control the family.

The finding from the research shows that, to a good majority of the respondents, Internet gives lessons on health and nutrition. Since women have to take care of the health of their children, spouses, parents and siblings, they need health information. Internet fulfills their need on health information. The findings of a research conducted by Ayers and Kronenfeld (2007) are inconsistent with this. They write that it is not merely the presence of a chronic illness, but rather the total number of chronic conditions that determine Internet use. Also, the more frequently a person uses the Internet as a source of health information, the more likely she will change her health behaviour. But in the present investigation, it is not found so, and the Internet is used by women users to find good health tips. One of the respondents of this study, Ivy Primrose, as discussed in case studies found the right way of treatment for her newborn son through the Internet.

In the traditionally constructed negative value system, a woman has to be at an extreme state of lack of power. But Internet helps her to have absolute power and she becomes an opinion leader to pass on information, to others in the family and the society. Most of the respondents agree with this.

The research findings show that Internet has helped women to take control of their reproductive rights and decide on their family size. Interestingly, when a woman gets respect, recognition and acceptance in the family and the society by being an *opinion leader*, surely she can take control of her reproductive rights and decide on her family size. When she enjoys such regard and respect, she can also share the domestic work with men, where once the men were only helpers but not sharers, as understood from the findings of the research.

Economical indicators

A woman can feel the economical empowerment only when she is allowed to generate income. The research findings show that Internet gives skill for income generation to the women who use it. Not only the highly educated professionals, but also the self employed women can get tips for tailoring, doing embroidery, crafts, stitching, pickle making, glass painting and the like. Exclusively, websites are available on all these subjects. If a woman successfully knows to use Yahoo, Google and MSN search, she can

find thousands of web sites carrying such information. The findings from the research show that Internet also helps the women to acquire, provide and bestow the resources and means for raising money. Selling of products by the women who engage in small scale industries without the intervention of brokers in the market is possible through Internet. They are able to govern and control their businesses. An NGO called WISHALL (Women In Self Help And Lord's Love), which encourages self help groups to manufacture a variety of widely-used home made products, use the Internet to promote the organization and sell the products. Internet also empowers women by helping them to involve in production that will allow them to have some degree of autonomy for earning some money without moving anywhere, as understood from the findings. The findings also show that Internet enables women to decide where to channel their income. To a good majority, Internet helps to be professionally updated and gain access and control over the means of production, property and other resources.

The findings show that Internet helps women to have choices. Call centres and outsourcing facilities open up a number of choices for women to earn money. Online tuitions, legal transcription, medical transcription, technical writing and editing are done through Internet for multinational companies. Graduates, who are fluent in English and Internet usage, are able to get plenty of chances to work in such areas.

On the basis of these findings, the empowerment score of Internet users is high altogether. It is noticed that they agree with all the empowerment indicators. So, it may be inferred that Internet empowers women. In an article on the history and structure of women's alternative media, Steiner (1992) documents that "For nearly 250 years, women have recognized the value of establishing and operating their own communications media, literally making their own meaning and communicating it to one another across space and over time". Women have created their own media of communication because they have been unwilling or unable to use the mainstream media, which is male-dominated. Mass media have consistently ignored and trivialized or marginalized women and the feminist movement. Feminists are discouraged even when women's issues do receive media attention because they are generally watered down and co-opted into the dominant discourse. There is no room for "the alternative visions, definitions and ways of being" advocated by the women's movements. It is for these reasons that many women seek out alternative media. As Steiner points out, women need a different media

"…..To articulate and dramatize their emerging interests, to nourish and defend an identity that imbues their lives with meaning. Not only can they thus mount an effective challenge to the dominant structures, ideology, and content, but they also derive considerable intellectual and emotional satisfaction from producing their own women-controlled and women-oriented media. In and through communication they transform and empower themselves (Steiner, 1992; Mallon, 2006).

In this way, Internet helps women to have their own medium, which is owned and controlled by them which in turn can lead towards empowerment.

Inferences and conclusions

From the findings and the discussion of the results of the present research it is understood that Internet helps the women who use the Internet in the right way to be empowered, mostly. If the socio economic factors and the applications of Internet are rightly correlated, the Internet can be used to its maximum potential to get more empowerment.

• In conclusion, age, educational qualification, languages known, number of children in the families and economic status of women do not directly influence the process of empowerment through Internet. Therefore, the Government and NGOs may take necessary steps to equip all women to use Internet irrespective of their age, educational qualifications, languages known, family size and economic status. This may facilitate the overall development of women through Internet.

• The professions, monthly Internet expenses and places of access of Internet influence the process of empowerment of women through Internet. It may be inferred that reduction in the cost of Internet usage especially to women and enhancement in the existing Internet facilities in the places of usage may further empower the womenfolk.

• Playing games, visiting virtual museums, visiting virtual libraries, being members in electronic news groups, doing financial transactions through Internet, 'blogging', looking for jobs through online consultancies and using Internet for travel information improve and speed up the empowerment process of the women Internet users. In this connection, proper awareness may be generated to womenfolk.

So, the Internet as a new medium can be an excellent tool for empowering the women of Tamil Nadu.

Recommendations

- Since India is a developing country, all the economic, cultural, psychological, social and

  technological barriers which prevent women from using the Internet to the optimum need to be removed. The Government may plan and implement specific programmes to take Internet literacy to every nook and corner of the country. As the pioneers in ICT for development have observed, to make information accessible and widely available, human and financial infrastructure is necessary. More money may be made available to support the work of women centres, archives and documentation centres. Funds may be raised to enable organizations pay for Internet connectivity.

- The shyness, unwillingness, timidity and fear that women have developed toward technology need to be changed.

- Safe cyber environment may be created in Tamil Nadu with immediate priority to provide committed and conducive support to women when they face difficulties online.

- Interactive and strategic ways of using Internet need to be developed than just data transformation and information management.

- The whole of Tamil Nadu may be networked through Internet, including the remote and the rural areas.

- Though Internet is a hugely promising medium of empowerment, most of the women are outside of this. The organizations which are working at the grass root level and in the interior areas are a step away from this technology, while most of the activists take up the causes of the wronged and the deprived. These organizations may give priority to Internet as well as the usual fields of tailoring, handworks, etc. for the development of women.

- Lack of financial resources and illiteracy keep thousands of people away from utilizing this technology. The Government and other funding agencies need to come forward to back the Internet projects for women with financial and moral support.

- Many cultural barriers prevent women from using Internet. The shyness, unwillingness, timidity and fear toward technology that women have developed due to the existing cultural constraints and restrictions may be cleared by providing awareness to them specifically.

- The poor and the marginalized may be helped via Internet to meet the experts in veterinary, animal husbandry, health and agriculture fields so that the researchers can focus their attention on the actual needs and wants of the people with real problems.

- Using Internet for travel information helps women to be self-reliant for information and to earn more money and thus be self-dependent. So, the women who are well-versed in Internet may opt for this opportunity to get empowered.

- The potential of Internet may be harnessed for spreading knowledge in the areas such as health, nutrition, telemedicine, farming, distance education, etc., among the women communities. In this context, trained women farmers may be able to access information via the Internet, such as commodity prices, laws and regulations related to agriculture and the best practices in farm management.

- The idea of Virtual Academy for rural prosperity suggested by experts in ICT for rural development, may be implemented seriously and informally in a women friendly way, where the women can combine traditional and modern technologies to facilitate a two-way communication that will connect the rural poor, farmers, etc. to get timely help on weather forecasts, availability of seeds and other farm inputs, advice on crops to be cultivated, depending on the soil, weather and market conditions, healthcare, education, employment, capacity building, Government entitlements, and so on. In essence, the Academy is a kind of a university (with no formal class room lectures or examinations) where anyone can learn what is relevant to her life. This may augur well for women.

- The Government may make positive efforts and provide the necessary support to document the history of women in the field of Internet in Tamil Nadu.

- NGOs and feminist organizations need to make efforts to complement the efforts taken by the Government. Strategies may be devised to change the absence of women issues in the media through Internet.

- Women may be given awareness about the email and hotline facilities arranged through Internet to expose the harassment and abuse they face at home and at work place. Feminist networks need to come up with alternative usage of Internet technology which contributes to solidarity of the women's movements. More concerted efforts may be made by the women's networks to make the hidden forms of violence, poverty and repression appears in the information networks, just as they happen in foreign countries.

- *Simputer* is another cheap alternative to personal computers that is being developed by Indian researchers with the aim of expanding IT access for poor communities. The simputer runs for eight hours on three penlight batteries. It also has text-to-speech capabilities in five languages. Smart card capabilities and a tough screen, accessible to those who cannot read and write are also attached with that. On the software side, a team from Hyderabad is now achieving close to 95 percent accuracy in the machine translation of northern Indian languages, and expects similar success with southern Indian languages. These developments could soon empower millions of people with affordable, multilingual computing, and give grass-roots governance the potential to make a significant dent on poverty in Asia. This would further empower the women of rural India.

- The Internet is yet to get democracy. Every person is not online and everyone does not have access to the technology. There is a social and cultural world outside the Internet that plays a role in determining who can access and have authority in cyberspace. Women themselves are diverse as a group and have widely varied levels of opportunities for accessing the Internet. This may be corrected to empower women and especially the marginalized ones.

- For all the media hyper and special features, the actual physical risks connected to the Internet are quite low. Stalking and rape occurring in real life as a result of a woman's presence on the Internet are still rare, while the psychological risks resulting from online harassment and flaming may be high. There are strategies and methods for dealing with these issues. Women need not have to be victims in cyberspace (Sinclair, 1996, p.15). Finally, as current and possible future users of the Internet, women may need to begin asking what is being given up by making choices in favour of the Internet. Whenever women choose to use the Internet, they are committing time and money that could be more beneficial somewhere else (Brayton, 1999). This may be a key issue in making women choose and use Internet – especially in rural India.

- Female mentors may be created and made available to help other women with technical knowledge. Mentors can also encourage other women to take an active role once they start using the Internet. Since women working in the field of Information and Technology are influenced more by Internet in the process of empowerment, they may influence the other womenfolk to get empowerment through Internet.

- Available positive role models may be highlighted from the women who already have an active role in the production and creation of the Internet. This includes recognizing the history of women's active participation in the construction and development of the technology in Tamil Nadu with special reference to Internet.

- Women may create awareness among other women about the Internet as a useful and necessary tool for their real lives. By being active online and by refusing to play the boy's games, and by creating spaces that reflect women's diversity and perspectives, women can show forth their autonomy and empowerment.

- Cyber law need to be contextualized so that women can face problems online from men boldly and not allowing such problems to become hindrances in their journey with and within Internet.

- The existing digital-divide between the rural and urban areas may be overcome partially by providing equal Internet facilities to all rural areas by the Government. This, in turn, may provide the benefit of empowerment of rural women.

- The Government once used the school-going children to educate their family members on literacy and the scheme was called *Arivoli Iyakkam* (Literacy movement). The children were provided materials to take literacy from school to their family members. The same concept may be used to take Internet knowledge from school to home, to their mothers and sisters, through the children and the youth by providing resources and knowledge through their educational institutions.

- The existing digital divide between the rural and urban areas in Tamil Nadu may be overcome partially by providing Internet facilities to all rural

areas by the Government. This, in turn, may provide the benefit of empowerment of rural women.

By applying these suggestions and recommendations the women in Tamil Nadu may be empowered.

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The science of telling stories:
Evaluating science communication via narratives (RIRC method)

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Abstract

It is quite reasonable to state that narratives can include, explain and recreate science (Gough, 1993; Appelbaum, 1995; Weinstein, 1998; Weaver, 1999 and Negrete, 2005) and that this means of science communication is popular among the public. This idea seems to be proved by the fact that many contemporary authors who include science as a theme in their work experience a good reception among the public (at least in Britain). Novels like *Fermat's Last Theorem* by Simon Singh, *Longitude* by Dava Sobel and Neuromancer by William Gibson stayed on the best seller lists for weeks, and plays like *Copenhagen* by Michael Frayn, *Arcadia* by Tom Stoppard, Oxigen by Carl Djerassi and Ronald Hoffmann. Also, *Diary of a steak* by Deborah Levy and *Blue heart* by Caryl Churchill produced complete sell-outs in London and other cities in Britain.

The explanation for this popularity seems to rely on the fact that they are amusing, attractive, and memorable. Therefore, we can affirm that narratives are popular. But are they also a long-lasting way of transmitting knowledge? Do people remember scientific information conveyed by this means better than they remember the traditional formats like paradigmatic text books? These are the questions that need to be addressed.

The RIRC method (we collectively labelled Retell, Identify, Remember and Contextualize memory tasks as RIRC, therefore the name of method) compares narrative and paradigmatic ways of communicating scientific information exploring effectiveness by comparing memory (learning) for narrative and paradigmatic information. The work at hand provides an interdisciplinary approach and a novel methodology to measure the success of communication using narratives as compared to other text formats.

Keywords: Science Communication, Science and Narratives, Science Communication Evaluation, RIRC Method

Introduction

Narrative knowledge is more than emotive expression; it is a legitimate form of reasoned knowing. This is the interpretation of Bruner (1988), who denoted the traditional logical-scientific mode of knowing as paradigmatic cognition, with storied knowing denoted as narrative cognition. Paradigmatic cognition has continually been identified as the only cognitive mode for the generation and transmission of valid and reliable knowledge. However, although the idea that more than one mode of rationality exists has long been ignored,

it has in fact for centuries been part of human culture (e.g. The Bible) (Polkinghorne, 1988; Lanza and Negrete, 2006). Today many scientists believe that both paradigmatic and narrative cognition generate useful and valid knowledge and that they are part of the human cognitive repertoire for reasoning and making sense of reality (Gardner, 1983). Both modes of thought provide different ways of organising experience, constructing reality and communicating knowledge. They are at the same time complementary and irreducible to one another. While paradigmatic knowledge is focused on what is common among items, narrative knowledge focuses on the particular and special characteristics of actions. Human action is the result of the interrelation among previous learning, experience, the present and future expectation. While paradigmatic knowledge is carried in individual words that name a concept, narrative knowledge is maintained in plotted stories. Narrative memories (stories) retain the complexity of the situation in which an action was undertaken, and with the emotional and motivational meaning connected to it. The collection of narrative experiences provides a basis for understanding new action episodes by means of analogy.

A great amount of effort has been placed in generating science communication, but how much is the public actually learning from science communication's intervention? This represents an important question to be addressed. Many organisations are turning to evaluation as an effective way of feedback. For people involved in science communication, evaluation has four benefits: (i) preparing for the evaluation before the event or presentation of material provides feedback, on what is intended to be achieved; (ii) providing information on the outcome of an event, the reception of a given material and suggestions for improvement; (iii) helping to know the audience better (C.O.P.U.S. 2002) and (iv) providing quantitative and qualitative evidence of the degree of success of the intervention.

How can we measure the success of communicating science?

The vast majority of studies of science in the media have focused on newspapers and television programmes because they are the most effective way, in terms of time and money, to study a mass medium. Moreover, almost every assessment of the effectiveness of scientific knowledge transmission is done through tests of factual knowledge and comprehension (Gregory and Miller 1998). In contrast, very little has been reported about the effectiveness of narratives

Memory is one possible way of assessing learning (Sternberg, 2003), and therefore of judging the success of communication efforts. In this sense studying how memorable are different ways of presenting information would represent a fundamental task for science communication. It is important to evaluate materials that not only need to be understood by the general public, but also must be retained in the long-term as a part of the learning process.

The method that the first author of this paper designed assesses the amount of knowledge remembered and learnt by individuals who have been exposed to scientific information in narrative format, in comparison to other texts containing scientific factual information (paradigmatic). The method also includes variables that reflect the different levels of understanding and uses them to measure the ability to Retell, Identify, Remember and Contextualise information (RIRC).

The RIRC method

The RIRC method uses different memory tasks in order to evaluate an individual's capability to retain scientific information. The tasks involve implicit and explicit memory. While explicit memory implies a conscious recollection, implicit memory, uses previous experiences that are not consciously and purposely recollected (Schacter 2001).

Different memory tasks indicate different levels of learning. Although recognition memory is usually much better than recall (Standing *et al.,* 1970), these tasks generally imply deeper levels of learning than recognition does. Recognition memory is sometimes associated with receptive knowledge, and recall memory with expressive knowledge. Differences between receptive and expressive knowledge are also studied in areas other than memory, such as in language work, intelligence studies, and cognitive development.

The RIRC method uses three basic tasks for measuring explicit memory: declarative knowledge, recognition, and recall. Additionally, one task for measuring implicit knowledge has been included: procedural knowledge (Table 1). Declarative knowledge refers to recalling facts. Recognition implies selecting or identifying items that an individual learned previously (e.g., in multiple choice). Retelling deals with producing a fact, a word, a story or some other item from memory. Finally tasks involving procedural knowledge are those where learned skills and automatic behaviours, rather than facts, are to be remembered.

Table 1. Tasks for measuring explicit and implicit memory

Task for explicit memory	Description	Example
Recognition (Identifying)	Select or otherwise identify an item as being one that you learned previously.	Multiple choice
Recall (Remembering)	Produce a fact, a word, or other item from memory.	Fill-in the blank
Free-recall (Retelling)	Repeat the items on a list in any order in which you can retell them.	A list of facts or a story
Tasks involving procedural knowledge (Contextualising)	Remember learned skills and automatic behaviours rather than facts.	'Knowing how' skills

These groups of memory tasks were selected in order to obtain a measure of how individuals retain and learn information, and the different levels of understanding involved when information is provided in varied text formats.

The RIRC method adopts some of the techniques and fundamentals used in the "vignette" method and in narrative enquiry (Amos and Wisniewski, 1995), but there are important differences which need clarification. The stories used as stimuli in this research belong to fictional literature. There is an explicit aesthetic intention, which is achieved generally by means of fiction or narrative tropes. They were not necessarily constructed as a human testimony eliciting an open end response (development of values). Stories in our present research are used as tools for communicating scientific information to individuals, not as tools for organising information provided by an individual. Nevertheless, the vignette method provided important information about (a) the type of data that could be obtained using stories, (b) the time taken for a respondent to read the stories, (c) the optimal length of a story, (d) the number of stories that can be read in one session, and (e) the possible mode of analysis used for the information.

In the following section we present an example of how we applied the method in several studies where the method was used to contrast narrative and paradigmatic capabilities in conveying scientific information. This section describes in some detail, the methodology used in these studies. In the last section of this paper we will briefly refer to some of the general results obtained in these studies. (For more information regarding details of the findings see Negrete, 2005 and Negrete, 2005 (PhD thesis).

The RIRC method as applied in the studies comparing the effectiveness between narrative and paradigmatic ways of communicating science.

Our research on novels and drama suggested to us that nowadays the public is indeed attracted to narratives. But how efficient are narrative texts when compared to factual ones in communicating science? And by which of these two forms of representation is the information obtained better understood and longer lasting in our memory? We thought that these two questions ought to be addressed. Therefore the aims of these studies were to explore the extent to which people were able to understand, remember and learn scientific information included in a short story (narrative mode) as compared to traditional factual texts (paradigmatic mode).

The methodology designed by Negrete includes a comparison between factual and narrative information remembered at two different times (via the RIRC method). Two stories were used: *Nitrogen* by Primo Levi and *Crabs take over the Island* by Anatoly

Dnieprov. This methodology was tested on a sample of first-year sociology students of Bath University (UK) (2002 and 2003).

Development of the stimuli

The narratives

The original length of the two short stories (*Nitrogen* by Primo Levi and *Crabs take Over the Island* by Anatoly Dnieprov), approximately 10,000 words each, did not allow the study to be performed as required for the test (The original stories can be consulted in Dnieprov, 1969 and Levi, 1985). This consisted of a one-hour session to read two short stories and to answer two measures. The stories were therefore condensed to be around 1,500 words in length in order to fit the time restrictions of the test.

The criteria implemented in condensing the stories were to delete all the passages within the narrative that were not central to the plot. Simultaneously, however, the aim was to preserve as much as possible those parts of the story where scientific facts or theories were mentioned. From a literary and a stylistic point of view, it was also important to preserve as much as possible of the wit, irony, metaphors, humour and any other literary structure which give the story its particular identity and momentum. The final form of the two adapted stories used in the tests can be consulted in the Appendix of this paper.

The lists of facts (paradigmatic stimuli)

The paradigmatic stimuli consisted of a list of all the scientific facts mentioned in each story. The facts were transformed into individual sentences, presenting such facts in plain textbook style -the extreme opposite of the narrative form- (Table 2 and 3).

Questionnaires (measures)

The questionnaires included two basic forms of question: multiple choice (identify), straightforward, and open-ended questions (recall). There was also a section where the participants were asked to retell the stories or to recall the lists of facts (free-recall), and a section in which they were presented with a hypothetical situation in order to explore procedural knowledge. To formulate each question, a short narrative with the hypothetical situation was presented to each participant. Then a brief explanation of the problem was provided (in a paragraph or two). The

narrative description was always related to the scientific theme of the story or the list of facts. The hypothetical questions also were intended to evaluate their capability to put the information in context, to use the information or, in the broadest sense, and to learn the information.

Each respective measure (stories and lists of facts) had the same number of questions regarding the participant's capability to retell, identify, remember and contextualise new information. This allowed for a comparison of the effectiveness of each of the stories to communicate science at different levels of remembering and learning. (Table 4. General structure of the measures, see also the Appendix for Nitrogen and Crabs measures).

Procedure

In the first session, the group of participants was randomly divided into two symmetrical groups (according to the seats that the individuals spontaneously took in the auditorium). The stories, lists of facts and measures were placed face down on each of the participant's desk (lists of facts and measures for the factual group, and stories and measures for the narrative group). When all the material was ready (placed on each participant's desk) the volunteers were asked to turn the pages, read the first stimulus and then answer its corresponding measure. The participants were required not to go back to the stimulus materials once they had started to answer the measures. Once they finished with the first stimulus and its corresponding measure, they were asked to continue with the second stimulus and its measure. The entire group completed the whole test in less than an hour.

In the second session, which occurred one week after reading the stories and lists of facts, the individuals that participated in reading the stories were provided with the same "narrative" measure of the first session while those that read the list of facts were provided with the one corresponding to the factual group. They were then asked to answer the measures concerning the stimulus material (*Table 5*).

Coding and marking

Identifying and Remembering tasks in both groups were marked by comparing the participants' answers to the lists of facts and stories provided as stimulus. Retelling in the factual group was marked according to the number of facts that an individual was capable of reproducing in the answers from an original list of ten.

Table 2. List of facts of Nitrogen story and the correspondent quotation on the stimulus story

Paradigmatic	Narrative
Fact sentence	Quotation of the story
Nitrogen	
1) Alloxan is a hexagonal ring of Carbon, Oxygen, Nitrogen and Hydrogen.	Alloxan is a hexagonal ring of oxygen, carbon, hydrogen and nitrogen; it is a pretty structure!
2) Alloxan can be obtained from Uric Acid.	The sole accessible preparation (for alloxan) was the oldest: it did not seem too difficult to execute, and consisted in an oxidizing demolition of uric acid.
3) Alloxan can be used to produce a permanent dye for lipsticks.	The client...He had read that alloxan in contact with the mucous membrane confers on it an extremely permanent red colour… a layer of varnish like lipstick, but a true and proper dye.
4) Nitrogen enters our body via the food we eat.	Nitrogen… it passes miraculously from the air into plants, from these into animals, and from animals to us; when its function in our body is exhausted, we eliminate it…
5) Uric Acid is abundant in reptile and bird waste.	…uric acid, very scarce in the excreta of man and mammals, constitutes, however, 50 percent of the excrement of birds and 90 percent of the excrement of reptiles.
6) Birds and reptiles eliminate nitrogen by packing it in form of solid uric acid. For these animal groups, water is important to keep; they cannot use it as a vehicle for nitrogen elimination.	…other animals, for whom water is precious (or it was for their distant progenitors –birds and reptiles-), have made the ingenious invention of packaging their nitrogen in the form of uric acid, which is insoluble in water, and of eliminating it as a solid, with no necessity of having recourse to water as a vehicle.
7) Pollina (Italian word for chicken waste) is highly valued by country people because it is a good fertiliser.	First of all, the *pollina*—that's what the country people call it, which we didn't know, nor did we know that, because of its nitrogen content, it is highly valued as a fertiliser for market gardens—
8) Nitrogen is the same in any substance; it does not change its properties.	…The trade of chemist teaches you that matter is matter, neither noble nor vile, infinitely transformable, and its proximate origin is of no importance whatsoever. Nitrogen is nitrogen…
9) To obtain alloxan it is necessary to use organic chemistry techniques.	… or perhaps my inexperience with organic preparations was boundless. All I got were foul vapours, boredom, humiliation, and a black and murky liquid which irremediably plugged up the filters and displayed no tendency to crystallise, as the text declared it should. Best to return among the colourless but safe schemes of inorganic chemistry.

Table 3. List of facts of Crabs story and the correspondent quotation on the stimulus story

Paradigmatic	Narrative
Fact sentence	Quotation from the story
Crabs	
1) Darwin developed the theory of evolution by natural selection.	"Yes, but Darwin's is a biological theory, the theory of natural selection of evolution and so on. . ."
2) A battery can be constructed with water and silicon.	"What do they have to drink water for?" I asked. "That's the way they fill up their storage batteries. In the sunlight, the solar energy is converted into electricity by means of a silicon battery and the mirror on the crab's back. It is sufficient to recharge the storage battery and for handling day-time operations.
3) Sand contains a high proportion of silicon.	"The silicon they need for the batteries come from the sand which is pure silica" said he.
4) Solar energy can be converted in electricity with a parabolic mirror.	In the sunlight, the solar energy is converted into electricity by means of a silicon battery and the mirror on the crab's back.
5) Solar energy can be stored in a battery.	… the solar energy is converted into electricity by means of a silicon battery and the mirror on the crab's back. It is sufficient to recharge the storage battery and for handling day-time operations.
6) The survival of the fittest means that an organism that is better adapted to the environment will survive, so his genes are represented in the next generation.	"What do you mean by fittest? They're all the same. As far as I can see, they simply multiply, reproducing copies of themselves… The more refined replicates will be those that quite accidentally accumulate peculiarities of design that will make them more viable. In that way, we will have generations of stronger, faster and simpler creatures. … they will devour one another and reproduce new versions again and again.
7) Organisms in natural environment accumulate small changes in their genetic material and this is sometimes reflected in their external appearance. Some of these small changes result better adapted to the environment; this is one of the mechanisms in which species change from generation to generation.	The more refined replicates will be those that quite accidentally accumulate peculiarities of design that will make them more viable. In that way, we will have generations of stronger, faster and simpler creatures.
8) Some physical characteristics of an organism that can represent an adaptive advantage are size, strength and mobility.	In that way, we will have generations of stronger, faster and simpler creatures. … These were a remarkable generation of mechanical crabs, smaller in size and capable of amazing speeds!
9) In nature the environmental conditions determine whether one organism is fitter than other.	The more refined replicates will be those that quite accidentally accumulate peculiarities of design that will make them more viable (in the environmental conditions). In that way, we will have generations of stronger, faster and simpler creatures (fittest).

Retelling in the narrative group was marked according to the number of scientific facts that an individual was able to mention (without prompting) when retelling the story (the expected answers can be deduced from tables 2 and 3).

Contextualising in both groups was marked according to an individual's ability to mention the scientific facts and also by his/her ability to use these in a systematic way in order to solve the specific problem required in the measure. These hypothetical questions (contextualising) were constructed with the scientific information extracted from the stories. Each participant had to solve a given problem by using the knowledge acquired from the stories or lists of facts. In each case the participant was expected not only to provide facts but also to use the scientific information in a systematic way to provide a solution for a problem. The expected answer was either a narrative description of an experiment, a process or the research in which the scientific information provided within the story, or a list of facts was used in order to solve the problem.

The following are examples of the content of possible answers to the contextualising questions included in the measures (see Measures in the Appendix):

Nitrogen

Question 9: Use the sea birds' excrement to fertilise the poor soil in order to increase the chances to obtain a good harvest.

Question 10: Use the group of alchemists working with organic matter (organic chemistry) and trying to convert it into gold. In the second part of this question, using bird or reptile waste to gather nitrogen and try to produce Alloxan for the face pigment.

Crabs

Question 9. A strategy to make big crabs mate only with other big crabs so the size of the population will not diminish in size (human selection). To move the big crabs to the other beach in the island (isolating them to the small ones) and try to breed them there.

Question 10. To build a battery with sand and water and charge it by constructing a parabolic mirror with the mirrors found in the refuge.

The scores of the correct answers for the questions regarding each of the memory tasks were added. In this way four marks were obtained (RIRC) from each participant in each story or list of facts. The marks ranged in Retell, from 0 to 10 scientific facts reproduced; in Identify, from 0 to 3 correct answers; in Remember, from 0 to 4 correct answers and in Contextualise, from 0 to 2 correct answers.

The measures (scores) were analysed at three levels: each measure separately; comparisons between stories and between lists; between each story and its respective list. These results were also compared with the ones obtained the following week.

Some results of the studies performed with the RIRC method

In the first session the factual groups tended to perform better in all the tasks, and in general terms the standard deviations of the narrative groups were higher than the factual ones. Altogether there was a better performance from the factual groups in terms of score and homogeneity. The second session showed important changes in the way people retain information. The differences in performance between the narrative and the factual groups diminished. The initial tendency of the factual groups to accomplish all the tasks better changed, and the narrative groups performed better in most of the tasks.

It is interesting that the factual groups experienced a decrease in score in all the tasks from one session to the next, while the narrative groups presented a gradual drop in performance and in some of the cases they even scored better in the second session. Despite a more homogeneous performance by the factual groups, in most of the tasks the differences between the first and the second session's standard deviation augmented in the factual groups and diminished in the narrative ones. The dispersion of the data suggests that while the information presented as lists of facts loses uniformity in time, the information presented in narrative forms tends to retain homogeneity better. The results suggest that in time the differences between the performances of the groups tend to diminish.

Discussion and conclusion

The results of the studies performed with the RIRC method as a whole suggest that science can be learned through literary stories. In particular, they suggest that narrative information is retained for lengthier time periods than factual information and that narratives constitute an important means for science communication to transmit information in an accurate,

memorable and enjoyable way.

The RIRC method proved to be a valuable tool to evaluate memory, understanding and learning via different memory tasks. Assessing the capability of individuals to retell, identify, remember and contextualise scientific information (a combined measure of memory tasks) provides a means to explore quantitatively and qualitatively the differences between narrative and paradigmatic modes of conveying science This allows for a more comprehensive analysis and offers interesting elements to evaluate success in communication.

The RIRC method enables one to perform a qualitative analysis on the stories reproduced by the participants in the retell memory task. In some of the studies performed with the RIRC method, the narrative structures of "Nitrogen" and "The Crabs take over the Island" stories were studied and contrasted with the narratives retold by the participants. This methodology was based mainly on Propp's analysis (1993), adding elements of other techniques for analysing narrative structures proposed by contemporary authors (Gusfield, 1989; Perinbanayagam, 1991; Atkinson, 1990; Potter and Wetherell, 1987). However, because of the limitation on length, it was not possible to include the analysis and results in this paper (see Negrete, 2005 PhD Thesis University of Bath UK).

This method has also been used to compare different narratives. This is the case of an investigation of the use of popular comic strips as a tool to communicate HIV medical information in Mexico. We used the RIRC method in order to assess individual's ability to learn scientific information presented to them in comic strip format (See PCST-10, 2008 Denmark proceedings).

The studies mentioned in this paper employed short stories written by famous authors, albeit they contained significant cuts for the purpose of the sample testing. The stories have a proven track record in terms of their literary qualities and were already translated into English. This saved a significant amount of time that would have been needed for creating new stories. However, this resulted in restricting ourselves to a fixed theme and a predetermined amount and complexity of science information within each story. For any future experiment, it would be desirable to write new original stories in order to gain complete control over the scientific themes involved, the information to be divulged, and the amount and level of detail contained.

Because of their length, short stories were used in this research as an example of narratives. This enabled the participants to read a complete story, or two stories in one session. The methodology examined in this paper refers only to short stories, but the underlying idea of comparing factual information and fictional stories would also apply to other narrative genres such as drama and novel. In future research it would be interesting to adapt the methodology in order to evaluate the communication capabilities of other genres and media.

For comparison purposes, the two extremes of written information were taken: fictional narrative in short stories and facts presented in lists. A number of intermediate written forms, however, do exist such as scientific journalism, popular science writing, multimedia and even non-written narratives such as video, cinema and radio. Again, contrasting these other media would offer an interesting future research task.

The work at hand provides an interdisciplinary approach and a novel methodology to measure the success of science communication using narratives compared to other text formats. The RIRC method provides important feedback before and after a presentation of narrative materials in terms of its capabilities to help people understand, learn and enjoy science. These elements in turn provide essential guidelines to improve the materials and provide a means to understand better the audience interested on this subject. The method provides quantitative and qualitative evidence (data) of the effectiveness of narrative materials in conveying science.

Given the proven popularity of novels and drama containing scientific information, as well as our findings regarding their efficiency in conveying information in a long-lasting way, we believe that the presentation of scientific information through narratives such as stories, novels, comics and plays should be considered an important means to convey information in the repertoire of science teachers and communicators.

However, more work on this area has to be done, including conducting larger surveys of the general public. For the time being this work proposes a methodology that offers several interesting points of departure for future research in communicating science via narratives.

Appendices

Nitrogen

The client explained to me that he was the owner of a cosmetics factory and he wanted to produce a certain kind of lipstick. He needed a few kilos of alloxan. He would pay a good price for it, provided I committed

myself by contract to supply it only to him. He had read that alloxan in contact with the mucous membrane confers on it an extremely permanent red colour, because it is not a superimposition, in short a layer of varnish like lipstick, but a true and proper dye, as used on wool and cotton. I gulped, and to stay on the safe side replied that we would have to see: alloxan is not a common compound nor very well known, I don't think my old chemistry textbook devoted more than five lines to it, and at that moment I remembered only vaguely that it was a derivative of urea and had some connection with uric acid. I dashed to the library at the first opportunity and hastened to refresh my memory as to the composition and structure of alloxan.

Alloxan is a hexagonal ring of oxygen, carbon, hydrogen and nitrogen; it is a pretty structure! It makes you think of something solid, stable, well linked. In fact it happens also in chemistry as in architecture that "beautiful" edifices, that is, symmetrical and simple, is also the sturdiest: in short, the same thing happens with molecules as with the cupolas of cathedrals or the arches of bridges. Alloxan was known for almost seventy years, but as a laboratory curiosity: the preparation method described had a pure academic value, and was made from expensive raw materials which (in those years right after the war) it was optimistic to hope to find on the market. The sole accessible preparation was the oldest: it did not seem too difficult to execute, and consisted of an oxidising demolition of uric acid. Just that: uric acid, the stuff connected with gout, intemperant eaters, and stones in the bladder. It was a decidedly unusual raw material, but perhaps not as prohibitively expensive as the others.

Subsequent research taught me that uric acid, very scarce in the excreta of man and mammals, constitutes, however, 5O percent of the excrement of birds and 90 percent of the excrement of reptiles. Fine. I phoned the client and told him that it could be done, he just had to give me a few days' time: before the month was out I would bring him the first sample of alloxan, and give him an idea of the cost and how much of it I could produce each month. The fact that alloxan, destined to embellish ladies' lips, would come from the excrement of chickens or pythons were a thought which didn't trouble me for a moment. The trade of chemist teaches you that matter is matter, neither noble nor vile, infinitely transformable, and its proximate origin is of no importance whatsoever. Nitrogen is nitrogen, it passes miraculously from the air into plants, from these into animals, and from animals to us; when its function in our body is exhausted, we eliminate it, but it still remains nitrogen, aseptic, innocent. We -I mean to say we mammals- who in general do not have problems about obtaining water, have learned to wedge it into the urea molecule, which is soluble in water, and as urea we free ourselves of it; other animals, for whom water is precious (or it was for their distant progenitors), have made the ingenious invention of packaging their nitrogen in the form of uric acid, which is insoluble in water, and of eliminating it as a solid, with no necessity of having recourse to water as a vehicle.

I returned home that evening and informed my wife that the next day I would leave on a business trip that is, I would get on my bike and make a tour of the farms on the outskirts of town in search of chicken shit. She did not hesitate, she would come along with me. But she warned me not to have too many illusions: finding chicken shit in its pure state would not be so easy. In fact it proved quite difficult. First of all, the *pollina*— that's what the country people call it, which we didn't know, nor did we know that, because of its nitrogen content, it is highly valued as a fertiliser for truck gardens—the chicken shit is not given away free, indeed it is sold at a high price. Secondly, whoever buys it has to go and gather it, crawling on all fours into the chicken coops and gleaning all around the threshing floor. And thirdly, what you actually collect can be used directly as a fertiliser, but lends itself badly to other uses: it is a mixture of dung, earth, stones, chicken feed, feathers, and chicken lice, which nest under the chickens' wings. In any event, paying not a little, labouring and dirtying ourselves a lot, my undaunted wife and I returned that evening with a kilo of sweated-over chicken shit.

The next day I examined the material: there was a lot of gangue, yet something perhaps could be got from it. But simultaneously I had an idea; just at that time, in the Turin subway gallery an exhibition of snakes had opened: Why not go and see it? Snakes are a clean species, they have neither feathers nor lice, and they don't scrabble in the dirt; and besides, a python is quite a bit larger than a chicken. Perhaps their excrement, at 90 percent uric acid, could be obtained in abundance, in sizes not too minute and in conditions of reasonable purity. This time I went alone: my wife is a daughter of Eve and doesn't like snakes. The director and the various workers attached to the exhibition received me with stupefied scorn. Where were my credentials? Where did I come from? Who did I think I was showing up just like that, as if it were the most natural thing, asking for python shit? Out of the question, not even a gram; pythons are frugal, they eat twice a month and vice versa; especially when they don't get much exercise. Their very scanty shit is worth its weight in

gold; besides, they—and all exhibitors and owners of snakes—have permanent and exclusive contracts with big pharmaceutical companies. So get out and stop wasting our time. I devoted a day to a coarse sifting of the chicken shit, and another two trying to oxidise the acid contained in it into alloxan. The virtue and patience of ancient chemists must have been superhuman, or perhaps my inexperience with organic preparations was boundless. All I got were foul vapours, boredom, humiliation, and a black and murky liquid which irremediably plugged up the filters and displayed no tendency to crystallise, as the text declared it should. Best to return among the colourless but safe schemes of inorganic chemistry.

Crabs take over the island

Remind the captain that we expect him back in exactly twenty days." the engineer ordered the sailors of the *Turtle-Dove* who had brought the last wooden box from the ship into the island. "Why the deuce did we have to come all this way to a solar hell with those machines of yours?" I asked Mr. Cookling He laughed out loud, opening his mouth wide and exposing a full set of dentures. "Oh, don't worry about that, we'll be needing the sun pretty soon. We've got an amusing experiment under way here to test the theory of—what's his name—" here he paused.—Oh yes, the English man, Darwin, Charles Darwin." "Let's first get a look at the map. The rest of the cargo will have to be spread out over a variety of sites. That's the way the experiment goes," he explained. During the next three days, Cookling and I carted the pieces of metal to different parts of the island. When we finished we returned to the tent for the last box. "Open this one with particular care," Cookling ordered. What appeared was the strangest-looking instrument I ever saw. It resembled a large metal toy in the shape of a crab. In addition to six big segmented appendages, there were two pairs of slender tentacles that terminated in a half-open "maw" which jutted out of this monstrosity of a beast. On the back, slightly depressed, was a tiny parabolic mirror made of highly polished metal with a dark-red crystal in the centre. "Pick it up and put it on the sand", Cookling said. In about two minutes I noticed the mirror on its back slowly begin to turn towards the sun. "Look, it's coming to life, come on, Cookling, what's all this about? Why did we come here after all?" "To test Darwin's theory." "Yes, but Darwin's is a biological theory, the theory of natural selection of evolution and so on. . ." I mumbled. "Exactly!" He said but I interrupted: "Look, our hero's decided he needs a drink

of water!" The toy crab was crawling towards the water. It lowered its proboscis and was obviously sucking up water. After quenching its thirst it crawled out into the sun again and came to a halt. Almost on the shore, was the first of the piles of metal bars. When the crab had come within about ten yards of the pile, it suddenly seemed to forget all about the sun, made rapidly for the pile and came to a halt right near one of the copper bars.

Next morning I went where we left our beauty the day before. Near the pile of metal bars were two crabs, both exactly like the one that we had extracted from the box the day before. "Did we actually miss one under the pile of bars?" I exclaimed. Cookling squatted, chuckling and rubbing his hands. "It was born here last night". They were using their slender front tentacles to contact the bars and produce electric arcs that melted off chunks of metal. Then they pulled the pieces through their wide-open jaws. Something hummed inside these steel beings. On the platform of the first crab was a third crab almost completely assembled. I was struck dumb. "Why these creatures are multiplying," I screamed. "Exactly, the sole purpose of this machine is to manufacture duplicates of itself. It's a replicating device," explained Cookling. "What do they have to drink water for?" I asked. "That's the way they fill up their storage batteries. In the sunlight, the solar energy is converted into electricity by means of a silicon battery and the mirror on the crab's back. It is sufficient to recharge the storage battery and for handling day-time operations. At night the robot is powered by the energy stored up during the sunny day. "So they can - work day and night?" "But there isn't any material for silicon batteries in these piles of metal" I ventured. "The silicon they need for the batteries come from the sand which is pure silica" said he. We returned to the tent in the evening, and by that time there were six robots hard at work on the pile of metal, and two more were basking in the warm rays of the sun. "What are these creatures for?" I asked Cookling. "For war. These crabs represent a terrifying tool of sabotage. Yesterday we began with a single crab. Right now there are eight out there. In ten days we will have ten million crabs. These crabs will be able, in short order, to gobble up all the metal the opposing side possesses: tanks, aircraft, all the metal in the country. Everything will be used up to reproduce crabs. And, as you know, metal is in war a strategic material of the highest priority.

One fine day Cookling stated triumphantly. "The most exciting thing is about to take place. All the metal has been devoured." All metal cubes, bars and rods had been turned into mechanical robots that were now

swarming over the island. "There it is: the first real fight!" shouted the engineer with glee and clapped his hands. "Why the need for this fighting? Pretty soon they'll start devouring each other!" "That's just what is required! The survival of the fittest!" I thought a bit and then objected. "What do you mean by fittest? They're all the same. As far as I can see, they simply multiply, reproducing copies of themselves. Can you imagine what would happen if every new item came out different from the original but like its immediate predecessor? "So what? All the better in fact. The more refined replicates will be those that quite accidentally accumulate peculiarities of design that will make them more viable. In that way, we will have generations of stronger, faster and simpler creatures. All I need to do is to wait until my mechanical beings eat up all the metal on the island and begin a war in which they will devour one another and reproduce new versions again and again. That is how I will get the ultimate devices I need." Within minutes the site had turned into a fierce battleground with more and more crabs crashing into the melee. These were a remarkable generation of mechanical crabs, smaller in size and capable of amazing speeds! They no longer felt the need of the traditional procedure of charging their batteries. They found the solar energy that their much larger mirrors were absorbing to be quite sufficient. With an amazing ferocity they swung out at several crabs and slashed them to shreds, taking two or three at a time. By noon, the entire beach around our tent was one grand battlefield. Robots from all over the island had converged on this spot. In the new warfare, one heard the crackling of numerous electric sparks, the banging of metal against metal and a grinding and crunching and ringing of machine against machine. Though for the most part the offspring was low-slung and extremely mobile, a new kind of device was emerging. The fresh species was larger than ever before. They were ponderous in their movements but possessed enormous strength and definitely had an edge over the tiny devices that were heedlessly throwing themselves into the assault. When the sun began to set, there was a sudden change in the movements of the smaller machines: they crowded to the western side and slowed down. "Oh, my God," exclaimed Cookling, "they are all doomed! These creatures are without storage batteries and life in them will cease as soon as the sun sets". Which is what happened. As soon as the sun dropped low life ceased altogether. Instead of a host of ferocious aggressive beasts, the place was an enormous graveyard of lifeless metal. Then the big crabs lumbered forth and ponderously took to devouring the little crabs

one by one. On the platforms of the giant progenitors, offspring of fantastic proportions was in the making. Cookling's face darkened. This kind of evolution was not in his calculations. Unwieldy mechanical crabs of such dimensions would definitely be a poor weapon for sabotage in the enemy rear.

Next morning, when I woke up, the engineer was still sleeping in the hot sand. I noticed a tremendous crab emerging from the bushes at the edge of the plateau. It was taller than I and its paws were long and heavy. The prehistoric mammoth of a machine stopped over Cookling and fell back on its haunches. The next instant, a cloud of sand shot up out of the mound. It was Cookling. Stung by the mechanical beast, he jumped up and tried to get away. But it was already too late. The thin tentacles had already wrapped themselves round his meat neck and were pulling him up into the maw of the robot. Cookling hung in the air helpless, throwing his arms and legs in every direction. Then I drew myself up onto its back. For an instant, my face was level with Cookling's distorted features. His teeth, I realized suddenly, Cookling had steel teeth! The crab began to jerk Cookling's pallid face and bulging eyes were now at the entrance to the construction maw. What happened then was terrible indeed to be told. Days passed by as I lay motionless on the shore peering into the distance from time to time, waiting for the return of the *Turtle-Dove*. Once, a huge shadow moved over me. I raised my head with great difficulty and saw that I was lying between the claws of a robot crab of tremendous proportions. It had come down to the beach and appeared to be scanning the coastline in wait of something.

Nitrogen Questionnaire

1) Retell the story in your own words,

2) Which of these molecules is Alloxan? (This question was eliminated from the analysis).
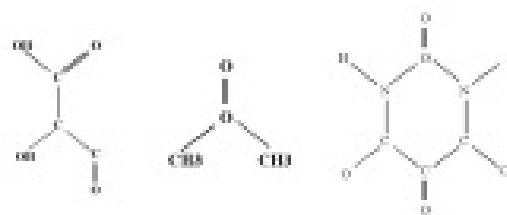
3) From which substance can Alloxan be obtained?

Citric Acid	Lactic Acid	Uric Acid

4) What are the characteristics of the geometrical structure of Alloxan mentioned in the text?

stable solid volatile asymmetrical	solid stable symmetrical well linked	well linked malleable symmetrical unstable

5) Why was the owner of the cosmetic factory interested in Alloxan?

6) How does nitrogen enter our body?

7) In which animal groups is the concentration of nitrogen in the excreta more abundant?

8) Why do these groups get rid of nitrogen in packages of uric acid?

9) Suppose you are a castaway on a remote island in the Caribbean Sea. It is a volcanic island, there are plenty of tropical animals but just one human being, you. From the shipwreck you managed to collect on the beach different items for survival purposes, among them a bunch of corn seeds. The soil in the island is rather poor, it is formed basically of volcanic ashes, so chances for germination of your seeds are low. What would you do to increase your chances to obtain a good harvest?

10) Suppose you are a time traveller. You were sent to the middle ages on a mission to retrieve important historical information. Everything was going according to plan until the King found out about your existence. Attracted by the rumours that you were coming from the future he appointed you to his court. As a way of proving your identity and loyalty to him, he set you the task of producing a permanent red colour to be use as a mask in his army to intimidate the enemy. He has warned you that your predecessor served as food for the lions because the red that he produced dissolved in the first rain and irritated the combatant's eyes so the enemy massacred his army. The entire group of alchemists in the kingdom is at your orders.

The first question the King asks you is which group of alchemists will you be using: the ones working in converting stones and metals into gold or those concentrated in converting rats, pigeons, ants and other living matter into the precious metal?

The second question is: what is your tentative plan?

Crabs Questionnaire

1. Retell the story in your own words (here a complete blank page was offered for the answer).

2. Which of these is the author of the biological evolution by natural selection?

Buffon	Cookling	Darwin

3. Which of these materials you need for constructing a battery?

water and salt	salt and silicon	water and silicon

4. Which kind of competition was the original experiment aiming for?

Inter-specific: among individuals of different species.	Intra-specific: among individuals of the same species.

5. Which substance is abundant in the sand?

6. How can solar energy be converted into electricity?

7. How can solar energy be stored?

8. What does "the survival of the fittest" mean?

9. Suppose you are a castaway on a remote Galapagos Island. It is a volcanic island in which there is only scarce vegetation and just one human being, you. There are two beaches, in one of them there is a population of one crab species, which, since you arrived this place has been your only source of food. The adult crabs differ in size and you have noticed, in your many spare hours, that when they breed the size of the offspring is somewhere between the size of each of the parents. At first sight the dimension of the crabs in this environment does not provide any advantage in mating or survival, so there is a wide range of size in the population. Nevertheless, only the big crabs are worth catching for food. You realise that as you have hunted the larger ones they have become more and more rare in the population, so the average size is reducing each generation. What would you do in order to reverse this situation and guarantee the availability of big crabs?

10. A world war is taking place and you have been taken prisoner by evil forces in north America but

you managed to escape to the Sonora desert in Mexico where you found friendly people and a refuge to hide in. This is a very remote village called El Reverso. The landscape is sand dunes, cactus and some desert wildlife that you have been taught by locals to hunt for subsistence. In the refuge you have some water reserves, basic commodities like soap, razors, mirror, toothpaste etc. You also have a radio and a lantern but there is no electricity or batteries in the town and the ones you brought inside the electrical appliances are all dead. You urgently need to tune into the BBC international transmissions on your short wave band radio to be aware of the war's progress. What would you do in this scenario?

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Scientoon

Around 2 million people in the world are affected by Insecticides and around 40,000 people die every year.

Bhopal Gas disaster is the worst of its kind in the world in which MIC gas killed 4000 people, 30,000 paralyzed and 40,000 people and their families were affected.

"Dear Insects! Be careful, Don't eat anything till we study the harmful effect of these new insecticides on human beings."

Is it girls are more curious than boys in education?

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Interestingly and appreciably, boys were dominated by girls during the school education in the recent decade in India, which is published in news papers and magazines at the end of every academic year. Most of the Indian academicians might be aware of this inspired incidence, even though consolidated data is not available yet. At Matriculation (or 10th std) and Intermediate or Higher Secondary (12th std or pre university) education, state or central level exam qualifying percentage is higher in girls' pool than boys' pool and top ranks were also mostly occupied by girls. This fascinating phenomenon is raising a major question among biologists and psychologists. Are girls more curious than boys in school education? This question is raised and widely discussed in public domain every year after annual exams in schools. Boys are often more active even though boys have greater failure rates during the school education. School education is the basement for developing Indian society.

Generally, hormones play major role in human morphology, physiology, psychology and behaviour. Especially testosterone and estrogen are vital sex hormones in male and female respectively after puberty. During the adolescent stage boys are often more active and aggressive than girls because of more production of testosterone. Some women take testosterone supplement doses for enhancing body strength and for developing domination behaviour against men. By and large, males are more aggressive than females not only in human beings but also in other mammalian species and male testosterone is critically linked to dominance competition for hierarchical advancement. By following this evolutionary significance and genetic rule men are projected as more dominant in human society in the terms of morphology, physiology, psychology and sexology. Most of the national and international biologists would agree with this view. Historically, examples of male-dominion and women-inferior data are very common and such dominion has always been attributed to some biological significance

explaining male dominance. Exceptionally some history of women dominion is also available.

Generally, human behaviour is influenced by a combination of psychological, physiological, cultural and perhaps even archetypal influences. One view is that women are more involved in the cultural and patriarchal influences and men to be involved more in the aggressive behavioural influences with increasing frequency of testosterone. In another view, most of the adolescent girls are involved in the indoor activities and most of the adolescent boys are focusing on outdoor activities according to the cultural and behavioural phenomenon. Sexually adolescents are more triggered and disturbed than matures. In the adolescent stage, boys have more freedom than girls in our cultural system and they are more susceptible to mind diversion. Consequently, adolescent girls are getting more opportunities to concentrate on their education than adolescent boys. That may be a primary reason for girls' domination in school education. At the same time many talented boys are also getting more marks and top rankings. The results of the study undertaken by the authors can thus be summarized that in the terms of curiosity, both boys and girls have equal opportunity to gain knowledge, even though, environmental and sexual influences may affect mental health of boys than girls in school education.

We should appreciate and encourage women in the Indian education, research and administrative activities. At the same time men also should aware in this context otherwise it will make complication in future. According to Indian government norms women are getting equal opportunities against men. They are also showing more interest in utilization of those norms and opportunities. This remarkable achievement also reaffirms the democratic nature of a rapidly developing India.   ■

News

Science Communication through Creative Genres

A National Seminar on Science Communication through Creative Genres was organized by the National Council for Science & Technology Communication (NCSTC) and Science Technology and Development Initiative (STAD) at Dehradun, Uttarakhanad during February 20-23, 2008. Over 150 delegates from across the country participated. The seminar provided the much needed opportunity to practitioners of different arts and crafts to discuss and devise novel and creative ways of communicating science to the masses. Discussions and presentations among and by the participants indicated that artistes, litterateurs and scientists together can not only work well but can also add an innovative and creative dimension to the public engagement of science.

The inaugural session in progress

First technical session "Science Fiction as a Creative Genre of Science Communication" allowed the participants to devise creative means of communicating science using styles and formats of literature. While Dr. Ramesh Chandra Sharma who belongs to the field of literature and chaired the session opined that science has to be transformed in order to be communicated through literature and said that fantasy too could be allowed in such genre, most of the scientists as well as science communicators suggested that the fantasy element may not be at the cost of established scientific principles. While Dr. Sharma used the term "Creative science literature", Dr.

H.P.S. Walia, a communication expert, emphasized upon bending the rules of literature in order to make it "popular literature".

His Excellency Governor of Uttarakhand is being honoured by Prof. S.K. Joshi

Second session, "Poetic Forms as a Medium of Science Communication" chaired by Dr. Madhu Pant witnessed a mix of science and artistic and poetic concepts and formats. Dr. Pant elaborated upon the use of everyday examples in such a genre and cautioned against adding anything non-scientific in such modes of communication.

Air Vice Marshal V.M. Tiwari (Retd.) is accepting honour frpm Mr. Ramesh Panwar

Third session "Creative Genres and Art Forms" once again proved the power of traditional forms such as folk theatre, folk songs and puppetry. The session deliberated upon the endless opportunities that Puppetry provided to the science communicators. It was

also opined that this is possibly the best form among the genre available. "The question now is how to make this genre more simple and interesting" the experts added. However the need of revaluating these genres as means of science communication on the basis of cost-benefit analysis was emphasized. Dr Sharma also called for devising means to measure the impact of these different creative genres. It could be thus argued that though at the moment science-art interactions are at a critical stage, the chief impact has been on the creation of new art forms and its ability to stimulate new thinking among the audiences. At last, it emerged that apparent isolation of almost hundred years of science from the arts seems to be ending in not so distant a future.

*Prof. Dhirendra Sharma addressing
at inaugural function*

Dr Manoj Kumar Patairiya, Director (Scientist 'F'), NCSTC and Convener of the Seminar, while participating in the deliberations during the First Session clarified that the Seminar amongst others has two major objectives:

(i) To offer a platform for a close and narrower discussion and interaction between the researchers, practitioners, literatures, artists, and beneficiaries of science communication.

(ii) To prepare for interaction among science, arts and literature for creating a new set of genre for bringing science to the social domain.

Out of the deliberations of the Seminar following recommendations emerged:

(i) His Excellency, the Governor of Uttarakhand Shri B.L. Joshi appreciated the idea of amalgamation of science, culture and literature to develop a new scientific culture suitable for sustainable development. In a separate meeting with the organizers and experts he also suggested devising

some mechanism to serve as interface between research and education in order to enhance the quality of science education and research in the Universities.

(ii) Prof. S.K. Joshi emphasized upon the need of popular science communication but warned against distortion of scientific facts. He also suggested that a National Award be constituted for communicating science through Creative Genres such as science fiction, poems, novels, folk songs and story-telling. Prof. Joshi also desired that the recommendations of the Seminar be consolidated and sent to the respective agencies or departments for appropriate action at their end. These recommendations and actions would also serve as the connecting links between different Seminars, he added. He also wants a group to be formed under Dr Manoj Kumar Patairiya to ensure that these recommendations are put to practice.

(iii) Mr Zeeshan Zaidi suggested the use of parallel cinema for science communication.

(iv) Dr. Madhu Pant felt the need for utilizing idioms and proverbs for making science communication more effective especially among rural people and suggested that selected science fiction stories should be translated from one regional language to the other.

A plenary session in progress

(v) The group observed that the training programmes initiated by NCSTC on science communication through different genres, i.e. science fiction, poems, drama, and folk forms, etc., are of high standard and quality; which may be promoted and extended to different parts of the country at local, regional and national level.

[Dr. Afrina Rizvi, Associate Professor, Department of Mass Communication, Aligarh Muslim University, Aligarh, U.P.]

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