Promotion of Scientific and Technological Temper
Empowering India by creating Scientific & Technological ambiance

Ms. Lipi K. Chhaya
Asst.Professor, Nirma University, Ahmedabad
lipi.chhaya@nirmauni.ac.in

Abstract

Science has several rewards as inventions are the result of diligent efforts. As Adam Smith has rightly said, "Science is the great antidote to the poison of enthusiasm and superstition." Science and technology has the ability to herald a revolution in terms of social, economical and intellectual. Science is the best art produced in the last century. Science education has an important role to play in the cultural and social development of human kind and for evolving a civilized society. The essence of scientific spirit is to think globally and work at a grass root level. Since scientific knowledge is universal in nature, promotion of scientific temper has become an essential matter for empowering India. Looking into the past, we can see all of the beneficial advancements we have made and how far we have come. Science and technology will continue to benefit society because there will always be new problems popping up over time that will need something bigger, better or a new cure for. Education is the base for scientific and technological advancements and personnel training of human beings. In the midst of overall concern of the rejuvenation drive, Education especially Science Education must get a strategic priority. The Founders of the Indian Republic gave a great importance to the nurturing of "Scientific Temper" among the society of this country by suitably incorporating it in our constitution. Though the country today can claim in various spheres like atomic energy, space ,telecommunication and information technology, it is a matter of regret that the Scientific temper among the society, more so with the educated civic has not progressed to the desirable extent. As scientific inventions gave birth to innovative technologies, continuous efforts should be made by the government and all of us who are educated and civilized and can contribute their best in the promotion of scientific temper.

Keywords

CSIR, DECU, ICT, Rain water harvesting, Renewable energy sources, scientific temper, Telemedicine.

Introduction

The word Science is from the Latin word *scientia*, meaning "knowledge" refers in its broadest sense to any systematic knowledge-base or prescriptive practice that is capable of resulting in a prediction or predictable type of outcome. The role of Science & Technology is of exceptional importance keeping in mind the economic and social importance. Scientific temper deals with what one sees, thinks and feels in reality or conceptually seeking the fact in real sense. One who can imagine can create. Scientific temper deals with imagination and creativity to find the reality. Acceptance of scientific temper is a passion to search for the reality. Promoting scientific temper of citizens is about bringing a fundamental change in their way of thinking, enabling them to question, analyze and reason better in all aspects of their everyday lives, making the scientific method a part of it.

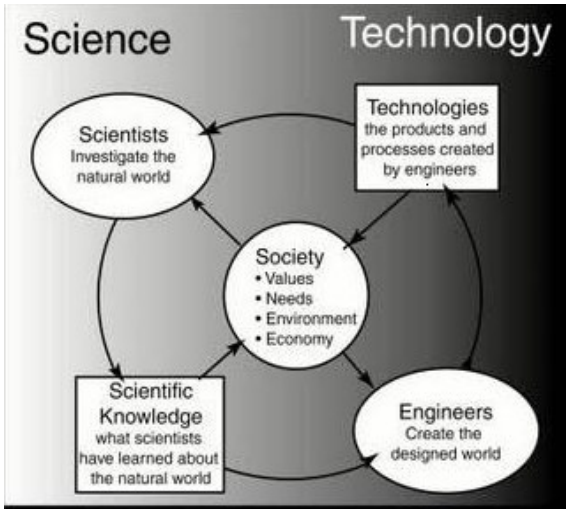

Figure 1. Science and society

Fig.1 shows the importance of science and technology in society. The necessity of harnessing science and technology for transforming India has long been recognized. According to article 51A in chapter iv(a) in constitution of India ,it is a duty of every Indian citizen to develop the scientific temper, humanism and the spirit of inquiry and reform; In fact, Mahatma Gandhi had clearly shown an appreciation of this as necessity. As early as 1935, at the All India Village Industries Association, Mahatma Gandhi initiated a movement called 'Science for People', with an advisory board of national personalities including scientists like J. C. Bose, P. C. Ray and C. V. Raman. By promoting the scientific and technological temper, we can emerge as a progressive and enlightened society, and can make it possible for all our people to participate fully in the development of science and technology and its application for human welfare.

Pre independence scenario

In ancient India, Maharshi Sushruta is the father of surgery. 2600 years ago he and scientists of his time conducted complicated surgeries like caesareans, cataract, artificial limbs, fractures, urinary stones and even plastic surgery. Usage of anaesthesia was well known in ancient India. Over 125 surgical equipments were used. Detailed knowledge of anatomy, physiology, aetiology, embryology, digestion, metabolism, genetics and immunity is also found in many texts. Before India became independent on August 15, 1947, science policy, if any, was determined entirely by the British government. There was no apparent, well-defined policy at that time, except that science and technology were not considered important elements in the development of India. There were few scientific institutions, and no obvious attempt was made to increase the scientific content of educational institutions or to create institutional structures and agencies devoted to science and technology. The only significant science agency was the Council of Scientific and Industrial Research (CSIR), established in 1942.There were, however, some leading scientists in pre-independent India. Important examples are: J.C. Bose (1858–1937), who invented radio wave propagation in 1905; C.V. Raman (1888–1970), who discovered the Raman Effect; S.N. Bose (1894–1974), who developed the famous Bose–Einstein statistics; and M.N. Saha (1893–1956), who worked on stellar physics. Two major scientific research institutions existed then: the Indian Institute of Science in Bangalore, and the Indian Association for the Cultivation of Science in Kolkata.The Indian National Congress, which was primarily responsible for carrying out the struggle for freedom, considered science to be an important element in India's future, and it deliberated on issues related to science and national development. The Congress Party developed its own science policy even before the first government of independent India was formed in August 1947.The Indian Institute of Science, the premier scientific research institution of India, was established from a donation made by the great Indian industrialist, JRD Tata, who approached the then Viceroy of India to establish a scientific research institution. Although the first three universities in the country-the University of Calcutta, the University of Bombay, and the University

of Madras were established in 1857, their principal objective was to train subordinate personnel for colonial civil service, and the three offered very few scientific courses. The Viceroy referred this matter to the Royal Society of London, which formed a committee for the purpose. The committee recommended that such an institution was needed in India and made it possible to set up the Indian Institute of Science in Bangalore in 1909. In 1933, C.V. Raman became the first Indian president of the institute, and served as professor of physics until 1948.The Indian Association for the Cultivation of Science was established by a great Bengali, Mahendralal Sirkar, in Calcutta. Sirkar, a physician and founder-editor of the Calcutta Journal of Medicine, wanted to establish an institution where Indians could conduct research in facilities comparable to those of England. Because he saw the association as a key to genuine independence, he insisted that it should be established and supported entirely by the indian community. Although little used, this institution caught the attention of C.V. Raman, a finance officer of the British government in Kolkata. This led to the invention of the Raman Effect, and Raman received the Nobel Prize for this discovery in 1930.The Tata Institute of Fundamental Research in Mumbai was founded in 1945 by Homi Bhabha (1909–1966) with a donation from the Tata Trust. The atomic energy programme had its birth in this institute.

Post independence scenario

After independence, under the leadership of Pandit Jawaharlal Nehru, the first Prime Minister of India, the national government made science an integral part of India's development. His vision for India's future depended heavily on the contribution of science to eradicate poverty and solve the many problems facing young India. His science policy resolution, proposed to parliament in 1958, is a landmark in the history of India. The essence of the resolution affirms the government's intent to support science and technology in order to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge. National Physical Laboratory was established in Delhi in 1947. It is at this Laboratory an inscription bears the words of Louis Pasteur: “Take interest, I implore you in the sacred dwellings which one designates by the expressive term, laboratories. Demand that they be multiplied and advanced. These are the temples of the future. There it is that humanity grows greater, stronger, better.’ After that the Atomic Energy Commission was set up in August 1948. It became full-fledged Department of Atomic Energy (DAE) in 1954 under Homi Jehangir Bhabha. The first nuclear power station at Tarapur started generating power in October 1969.Two such centers came at Kota in Rajasthan and Kalpakkam near Chennai in Tamil Nadu. The fourth one was set up at Narora in Uttar Pradesh. Besides the availability of Hydro-electric power, these centers generate power which is very essential for industrial development. India carried out peaceful nuclear explosions at Pokhran in Rajasthan on18th May, 1974 and 11th May, 1998. Council of Scientific and Industrial Space research has made appreciable progress in India. Dr.Vikram A.Sarabai expanded the work of the Indian Space Research Organization India’s first satellite, Aryabhata, was launched in 1975.India has also launched other satellites Bhaskara I and II. India has launched Satellite Launch Vehicles SLVs), Augmented Satellite Launch Vehicles (ASLVs), Geo-Synchronous Satellite Launch Vehicle (GSLVs) and Polar Satellite Launch Vehicles (PSLVs).A series of Indian National Satellites (INSATs) launched from 1982 onwards have revolutionized our different fields like television, telecommunication, resource survey and management, environmental monitoring ,meteorological and information technology systems. In Oceanography, Indian scientists have made good progress. Our missile technology has improved due to the contribution of our former president and

prominent personality Dr.A.P.J. Abdul Kalam.We have progressed in many fields like food, fuel, fertilizers, physics, electronics, aeronautics, cosmic rays and chemistry. Our scientists have set up a research centre at Antarctica. It is called as the Dakshin Gangotri. In the field of agricultural research M.S. Swaminathan has contributed much for the success of the Green Revolution in India. Nehru's Government appointed a Scientific Manpower Committee in 1947 to assess the technical personnel needed for the country. It led to the establishment of the Indian Institutes of Technology (IITs) at Chennai, Delhi, Kanpur, Karagpur and Mumbai. Later two more have come at Roorkee and Assam. They have produced many trained technologists. India stands third in having trained technologists next to the United States and Russia. Computer engineering is popular in India. There are many computer scientists, engineers, and technocrats in the country.

Hurdles in the path of science and technology

As lord Krishna in Bhagvad Gita says, ''Agnanena avritam gnanam tena muhyanti jantavaha''. It means, it is because of ignorance that man is deluded. There are many challenges which are sought to be handled with Scientific & Technological interventions. There are many hurdles in the path of science and technology like superstitions, poverty, illiteracy and delusions. Over the last 50 years, successive Governments have been committed to achieve the national goal of universal education and have steadily increased the budgetary allocation for education. However, 35 per cent of our adult population is yet to achieve literacy. Science is the study of the physical world and its manifestations, especially by using systematic observation and experiment while superstition is an irrational but usually deep-seated belief in the magical effects of a particular action or ritual, especially in the likelihood that good or bad luck will result from performing it. Superstitious beliefs have retarded human progress from time immemorial. Swami Vivekananda said that 'I would rather see every one of you rank atheists than superstitious fools, for the atheist is alive and you can make something out of him. But if superstition enters, the brain is gone, the brain is softening, and degradation has seized upon the life.' To promote the scientific temper of the society, we have to change attitude and mindset of citizens. Sometimes the circumstances in which they are placed are also responsible for mistaken beliefs. We are also facing the basic problems of energy and water. Farmers in the rural area are not aware about the water to pesticides ratio which results into insufficient and inappropriate crops. Despite some of the visible progress in the field of science and technology, the propagation of some of the society relevant issues like gender equality, population growth is still noticeable. This clearly shows disparity in human development. The biggest challenge is how to minimize the visible gaps in development. With the help of science and technology we can overcome some of these hurdles. We need sustainable development to create scientific and technological ambiance.

Implementation strategies in different sectors

1. Education

Change in curriculum, Change in Teaching methodology,Internet,Tele education, Printed learning Material, Literacy Campaign, ICT,Awareness programmes by Universities and institutions ,Global education, Science clubs, Science Fairs,Science and technology Exhibitions, Science parks, Science cartoons & comics, Mobile library, Industry institution interaction.

2. Healthcare
Health awareness campaign, food and nutrition awareness, Media, Telefilms, Community FM, Telemedicine.

3. Energy conservation
Non conventional energy sources like bio mass, Solar Energy, Wind power, Renewable energy sources.

4. Water mission
Rain water harvesting, Sea water desalination using solar energy, Redistribution of water, Drinking water availability
.
5. Food and Drug control
Awareness about quality of food and drugs, Awareness programmes by doctors, Hyginic process of manufacturing and packaging.

6. Pollution control & Environment
Fuel efficient vehicles, stringent rules and regulations for waste management , Use of non conventional energy sources.

7. Women Empowerment
Community FM, Night schools, Health awareness campaign, literacy campaign, Computer literacy, Anti superstition campaign, Lectures regarding food and nutrition, Gender equality campaign.

Creating scientific and technological ambiance

It is mentioned in the forth verse of Bhagvad Gita, there is nothing like knowledge which makes us sacred. So, we have to bring out the fire of knowledge to dispel ignorance. We don't have lack of scientists, engineers and science graduates but we have a lack of people with vision. It may be possible that a scientifically and technologically educated person may lack of scientific temper and on the contrary, less educated or arts or commerce graduate person can have more inclination towards science. Scientific temper reflects one's reasonable, cogent, diagnostic and vital thinking. The scientific temper and technique of science depict one's overall persona. With the strong support of government and society, we can promote the scientific temper of society and can empower our nation. According to Dr. Kalam's opinion to promote the scientific temper,'' Everything you do, you ask a question, what you are doing scientifically? Also, ask yourself, how you can do it better within the existing resources in the circumstance you are placed? Cultivate this habit among the youth. This will be a good way of promoting scientific culture.''To promote the scientific temper of society, we need to change viewpoint of citizens, a paradigm shift. The commercialization of an improved technology in a rural area requires the concurrence of the ultimate user (individual, household or community) of technology. In turn, this concurrence depends upon the potential user understanding the costs and benefits of the various technological options, knowing about the improved technology and being aware of its relative advantages. A large number of technology users, however, are unaware of the advantages of the technology and of its cost-effectiveness. The obvious way of overcoming this barrier is to provide information in various ways. Whereas door-to-door canvassing, leaflets through the mail, newspapers and magazines are effective in urban areas with literate target audiences. In rural areas, demonstrations must play a key role in addition to radio and television. And, of course, the training of technology users is a powerful way of educating them with regard to the advantages of the technology. Thus, the supply of relevant information and the education of the technology users are the means of overcoming the barrier posed by the uninformed. The curriculum and teaching methodology should be changed. More emphasis should be given to practical knowledge. We should focus on global and state of the art education. We can promote scientific culture through missionary schools, madresa and other religious bodies which provide religious education.Science

fairs, science club, science tours, and Science magazines are the effective ways to promote the scientific temper. Only one governing authority should be there for affiliation of institutions. Government should come up with the plans like 'Earn while you learn science' for illiterate citizens. The biggest challenge is a brain drain. We should make efforts to provide job satisfaction to our youth in India so we can utilize their knowledge in a best way. Apart from this, the satellite communication can be a great help for creating homogeneity among the heterogeneous group. The education programme through satellite is started by BISAG to educate rural people.Fig.2 shows that how education can be made available via satellite.

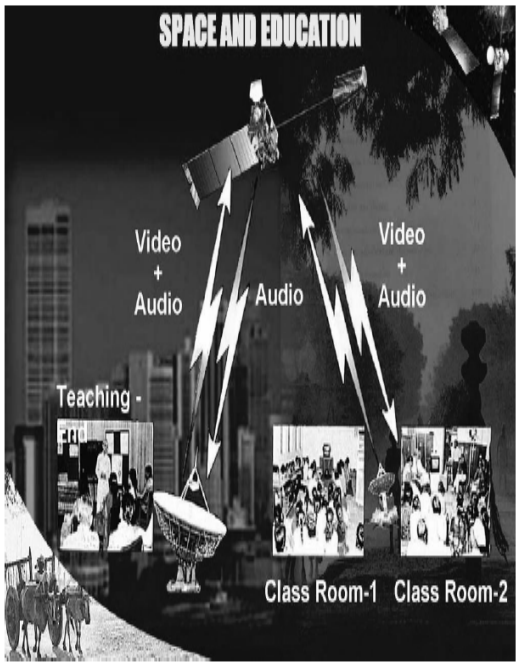

Figure 2. Education through satellite
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Telemedicine is an important initiative of Department of Science to use space technology for societal benefits. While DOS provides the telemedicine systems with software, hardware and communication equipments as well as satellite bandwidth. The state governments and the specialty hospitals have to allocate funds for their part of infrastructure, manpower and maintenance. Technology development, standards and cost effective systems have been evolved in association with various state governments, NGOs, specialty hospitals and industry. DOS interacts with state government and specialty hospitals for bringing an understanding between the parties through an MOU.DECU in collaboration with NDMA is producing a video programme on role of science and technology in disaster management. These examples show the value of information and services provided by our science and technology community to the society, to the service of our people. The main objective of science communication is to convey scientific information may be adopted by the corporate sector within an overall national mission for education.540 million youth of our nation can be a driving force to build prosperous India. Apart from utilizing youth, we can also use the experience and knowledge of retired persons from different fields as a source of motivation. Different organizations and institutions can be integrated to design the curriculum based on age group and qualification, which should be a mandatory certificate course to acquire a job in different fields. Industry institution interaction is an effective tool for promoting scientific culture. For science and engineering students, membership of different associations like IETE, IEEE, ISTE etc. must be made compulsory. Science Park, Science rides, Science films and science fairs are effectual tools to educate children. Doctors and pharmacologists can organize health awareness programmes to educate rural community. Engineers and science graduates can contribute in the areas of technology, science, agriculture, energy and water resources. Water harvesting and use of renewable energy sources can solve the problem of water and energy crisis. Motivation is a key factor for progress so; more number of awards and recognitions must be given to the worthy citizens of our nation. To create the scientific and technological ambiance, the tools like help line, anti superstition campaign, cleanliness

campaign, literacy campaign,ICT, street plays, media and entertainment industry, education programmes by universities and institutions, health alertness programmes, advertisements on local TV channels, awareness campaigns by Non government organizations and science communication can be employed .There must be utmost priority for women education. When the women are empowered, a stable society will emerge.

Acknowledgement

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Conclusion

Empowerment of India by creating scientific and technological ambiance requires combine efforts of government and society. We have to disseminate scientific knowledge among the community to realize the relevance of science and technology in their daily lives. Scientific temper must be cultivated in our citizens with absolute capacity for decisive evaluation. This step can be easily cultivated in our 540 million young minds so that they will blossom into valuable citizens of this nation. We have to impart scientific temper in the thoughts, actions and deeds of our civilization. Efficient use of existing knowledge can create comprehensive wealth for nation and also improve the quality of life. Our vision should be nurtured and translated into missions. Our consistent and focused efforts will make India a proud, prosperous and developed country.

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