<table>
<thead>
<tr>
<th>Title</th>
<th>Science and technology culture through education programmes: Indian experience.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>Agrawal, D. P.</td>
</tr>
<tr>
<td>Date</td>
<td>1997</td>
</tr>
<tr>
<td>URL</td>
<td><a href="http://hdl.handle.net/10220/2632">http://hdl.handle.net/10220/2632</a></td>
</tr>
<tr>
<td>Rights</td>
<td></td>
</tr>
</tbody>
</table>
Science & Technology Culture Through
Education Programmes: Indian Experience

by

Prof. D.P. Agrawal
Joint Educational Adviser
Ministry of Human Resource Development
New Delhi

Expert Group Meeting on
Training to Popularise
Scientific Technology Culture
28-31 May, 1997
SINGAPORE
1. **Introduction:**

Later half of the 20th century has seen unprecedented growth of Science and Technology (S&T) all over the world. There is no aspect of humanity, today, which is not affected by S&T. Infact its applications are now integral part of social life and culture and are recognized as vehicle for the well being and prosperity of societies and communities. This recognition has lead to newer policy initiatives by governments.

Science and Technology have universal character, its own distinct culture, values and ethoes, practices, methods and attitudes. The governmental policies, however, need to recognise local environment, social fabric, historical background and culture for S&T to deliver required benefits. It has been seen that in many developing countries customary behaviours, values, beliefs evolved from its historical part are highly deep-rooted and that any undermining of these act counter productive in the development of scientific temper.

This aspect is very crucial in Indian context as India is multicultural with very diverse traditions and rich & diverse flora and fauna. Large part of its population live in rural setting whose community canvas is dotted with heterogeneous social groups, value base and economic background. Popularization of S&T in such a mellieu need to assume different themes and face different obstacles.

It is well established that the educational system of a country is an obvious platform for popularization of S&T, which may assume the form of technical input to
rural and other disadvantage groups for career development, awareness about social and health issues, sensitization about application and manifestation of S&T etc.

Further, UNESCO, 1983, “Science for all” report provides concrete goals to be aimed which inter-alia include development of scientific climate and temper in all segments of population, identification of priority areas to meet specific target groups, inclusion of science and technology components in all type of education and extensions and natural initiatives and science policies. Positive role of popularization of S&T in India is visible through projects in areas of women in development, integrated child development, family planning programme, immunization programme etc.

2. **Policy Perspective.**

In India goals of social development are enshrined in its constitution which envisages a society based on “justice, social, economical and political; equality of status and of opportunity”. To achieve these goals it has considered educational programmes to be a major instrument. The education commission (1964-66) referred to education as the only instrument of peaceful social change. The challenge of education - a policy perspective, 1985 further emphasise it and calls for inclusion of S&T component in educational curricula at all level in the new education policy.

Improvement in the quality of science education and promotion of scientific temper, always got prominence in education in independent India. It was reiterated in
the National Policy on Education (NPE), 1986. Operationalisation of these objective, among other actions, involve provision of science kits to upper primary schools, supply of books on science related subjects, training of science and mathematics teachers, involvement of voluntary agencies for conduct of experimental and innovative programmes. A centrally sponsored scheme, “Improvement of Science Education in Schools”, was initiated by Govt. of India in 1987.

The NPE also provides that the protection of environment is a value, which, along with certain other values, must form an integral part of curricula at all stages of education. Operationalisation of this objective requires that the mind and intellect of the students must be sensitised about the hazards inherent in insulating and over exploiting the bounties of nature, and to inculcate awareness and respect among them for the basic concepts relating to conservation of environment. A centrally sponsored scheme “Environmental Orientation to School Education” was initiated by the Government as early as in 1988 which provides assistance and a co-ordination mechanism to build the efforts of state governments/voluntary agencies.

In order to promote computer literacy, a project on Computer Literacy and Studies in Schools (CLASS) was initiated as a centrally sponsored scheme of the Government. Infact, all curricula for diploma and degree programmes in engineering and technology contain inputs of computer.
3 Structure of School Education

For the children of age group of three years and above there is provision for pre-primary education. However, the same is not available universally. The formal primary education system starts when the child is five plus years. In some states primary education is for four years i.e. classes I-IV covering children of the age group of 6-9 years and in some states, it is for five years i.e. classes I-V covering children of the age group of 6-10 years. Table 1 indicates the growth of elementary education. Accessibility of schooling facilities is no longer a major problem, 94% of country’s population have now schooling facilities within one kilometer distance at primary stage. Gender disparities are conspicuous in regard to enrolment and retention as girls still account for 43% of enrolment at primary stage and 39% at upper primary stage. However, growth of enrolment of girls has been higher than that of boys in recent years. The NPE 86 also takes a realistic view of the reach of formal schools to millions of girl and school dropouts. It called for a large and systematic programme of non-formal education with flexibility to learn at the own pace of the learner. Currently primary education has been made compulsory under the Indian law. It is now being made a fundamental right.

Similarly, Upper Primary Education covers classes V-VII and children of age group of 10-12 years in some states and classes VI-VIII covering children in the age group of 11-13 years in other states. Secondary education is divided into two folds; classes IX- X and classes XI- XII in what is known as ten plus two system. Class X pass
outs could move to technical and professional diploma programmes. The input to tertiary education is after twelve years of school.

4. **Science education at primary and secondary level.**

Science teaching as a part of curriculum usually starts from Class III through a course entitled “Environmental Studies II”. However, informally the teaching of sciences, natural and social, starts from class I itself. There are no books for children at this stage but teachers have support from a handbook. The learning is guided mainly through recitation of poems, observation of environment and through games. At upper primary level i.e. classes V-VI science course is known as “Science” and it is this course which continues upto class X.

Secondary education begins at Class IX and continues upto Class XII consisting of children of the age group of 14-17 years. As per the Fifth All India Education Survey, 1993, approximately about 20% of the children graduate to class IX. As already stated during classes IX-X, science is taught through a course, known as “Science.” However, at classes XI- XII, specialisation is introduced. Some of the science subjects which the students choose in a particular combination are Physics, Chemistry and Mathematics, what is generally known as PCM or Physics, Chemistry and Biology, generally known as PCB. The latter combination has an option of not studying mathematics. Apart from general scientific courses, many states in India like Karnataka have started vocational programmes at Class XI level. Introduction of vocationalisation is done through one or
two specialised vocational courses parallel with general courses. Specialised vocational courses also have practical elements in their curricula which in many cases require use of laboratory or tool room.


The primary task of popularising science and technology amongst students is entrusted to the National Council of Science Museums (NCSM). This is an autonomous organisation under the Department of Culture, Govt. of India. The NCSM administers 26 science museums and centres which include 4 national level museums and centres, 3 state level centres, one research & training laboratory, 7 regional centres, 12 district level centres and one science city. The NCSM is continuously expanding and developing new centres across the country. It has developed a large number of exhibits which includes working models, robotic dinosaurs, gigantic dinamotion exhibits and life science exhibits. Interactive computer learning facility is the latest addition. The NCSM also organises model science exhibitions in school compounds situated in villages or small towns. It also arranges science demonstrations on anti superstitions. In addition to its commendable efforts in India, the NCSM is also developing a project called “development of science centres” in Mauritius.

The Department of Science and Technology of the Govt. of India, through its scheme for popularizing science and technology, has formulated a number of initiatives. Some of these include the National Children’s Science Congress (NCSC) and training of
resource persons in science and technology communication. Media based initiatives include production of video programmes like 'Bharat-ki-Chhap' (Stamp of India) a 13 part serial on history of science & technology in the Indian sub-continent produced in 8 languages. Another 12 part programme ‘Kyon Aur Kaise’ (How & Why?) has been broadcast on the national Doordarshan channel. Similarly, 144 part radio serial on ‘Human Education’ is broadcast from 84 radio stations of All India Radio in 18 languages. State Councils for Science and Technology (SCST) have been set up at state level for developing and popularising science activities through creating a network of individuals and voluntary organisations.

At the national level, there is the National Council of Education Research and Training (NCERT) which formulates curricula and course material for schools, both at primary and secondary levels of teaching. Similarly, State Councils of Educational Research and Training (SCERT) are responsible for producing course material like textbooks etc. in local languages at the state level. These bodies along with National Council for Teacher Education (NCTE) mount teacher training programmes in an integrated manner.

National population education project in school and non-formal education aims at developing educational response to population issues, making learners aware of inter-relationship between populations and developmental issues & developing in them a national attitude. The University Grants Commission (UGC) also has been assisting through UGC-UNFPA project, the promotion of population education programme in the
The programme is aimed at enabling students, teachers, and the community at large, to comprehend the issues concerning size of the family, quality of life, and the impact of population growth on the society and the nation. The UGC has set up 12 Population Education Resource Centres (PERCs) to provide technical support to the universities/colleges for various activities like material development, curriculum development and training for the functionaries and also carry out monitoring and evolution of the programme.

Efforts have also been initiated to integrate Population Education components in the undergraduate and postgraduate curriculum, starting with selected themes on population dynamics like family size, spacing of children, age at marriage etc. The scope has gradually been expanded to cover larger areas like health, immunization, nutrition, drug addiction, AIDS awareness and environmental issues to focus on the quality of life.

The community-based activities in the service areas have ranged from lectures to exhibitions, video shows, folk dances, street plays, community quiz programmes and painting contests. Attempts have been made to link literacy with Population Education programmes. Some of the community outreach programmes included organising immunization camps for women and children, camps for discussion and decision-making on social evils like dowry, child marriage, etc.
Educational Technology Scheme provides for application of technological innovations to improve quality of S&T education at all levels. This initiative is also supported by science kits provided to students in schools.


Parents

The attitude of parents to science teaching is very positive and they want that their children should excel in science. There are two reasons for this. Firstly, many of the parents themselves do not know much of science and hence treat science especially mathematics as an abstract subject; there is even a certain amount of fear in them about such subjects. However, they wish that their child should grow out of that fear and do well. Secondly, parents understand the link between science and professions like technology, medicine, pharmacy. Such professions are lucrative from not only point of view of earning money, but also social prestige angle. In fact, it is the latter reason which primarily makes parents urge on their children to take up science courses and perform ably. Needless to mention, such support from literate parents is very active.

Apart from encouraging their children to take up science subjects, parents also help them in all possible ways so that their children do well in those subjects. It is clear from what has been said above that their help to children in learning science is
facilitatory i.e. they provide possible facilities that they can afford; from science kits to computers. However, large numbers of parents are not able to help children in their home work in science or mathematics.

Local Community

Linkage with schools and local community is through a wide variety of mechanisms. In many states science fairs, book melas are organised by local bodies or Non-Government Organisations (NGOs) which bring schools and community together in some limited way. However, these are mainly organised in states/districts and may not trickle further down to village level. There are a few innovative experiments like the Lok Jumbish, Eklavaya, Kerala Shastra Sahitya Parishad (KSSP), Tamil Nadu Science Forum, All India Peoples Science Network, that have programmes which link promotion of science teaching in schools through the community route especially at the rural level. Similarly, there are other such bodies like the Centre for Science and Environment at Ahmedabad, and the Homi Bhabha Science Centre in Bombay which help in bringing science to the community and thereby encouraging linkages between community and schools. Agricultural sciences are brought to people through institutions known as Krishi Vigyan Kendras.

Out of wide range of practices claim to popularise S&T, effort has been to actively involve the rural communities and other disadvantage groups with the objective of career growth, self employment, appropriate technology solutions to everyday problems. Technology Policy Statement (TPS 83) spell out the need to input
technologies to meet the requirements of weaker sections of society and backward region. UNDP 1994, Human Development report states "to address the growing challenge of human security a new development paradigm is needed that puts the people at the centre of development".

These goals are being fulfilled through the Scheme of Community Polytechnics, initiated in 1978. It aims at sustainable community development without environmental degradation by way of S&T applications. Scheme lays stress on participation of women in culture-specific, non-formal and need based programmes of short term training in skills. These polytechnics with the help of local community leaders carry out socio-economic surveys, S&T information dissemination and awareness. A number of these polytechnics are actively engaged in planning and implementation of community support services, rural health services etc.

7. Cultural relevance

Science curriculum in India, till recently has been information giving rather than encouraging and inculcating development of scientific concepts among learners and limited in the input of local culture and materials in teaching of science. However, this trend is changing very rapidly. For example the Lok Jumbish Programme in Rajasthan State of India brings out a publication called "Khoji Pothi" in order to inculcate certain concepts of environmental science in children of classes III-IV, so that they are encouraged to carry out experiments and learn from them. Similarly, there are a large
number of private publications produced by local publishers whose textbooks are mainly used in non-governmental private schools which encourage development of concept in children and create interest. Open ended interaction is encouraged between children and their environment through materials produced by a non-governmental organisation, namely, Eklavaya also known as Hoshangabad Science Teaching Experiment.

There is no reason to believe that science curriculum at the design stage is in any way biased towards either boys or girls. However, some gender bias may be observed in implementation, say at the time of textbook writing or say designing play methods. There is a conscious attempt to make all such aids, gender neutral. A number of other experiments through NGO's has been initiated for integrating local culture & materials and espirement in the learning of science. Most of them take a holistic view keeping learners at the centre.

8. **Movements for change.**

There is a thinking among scientific community that the way science is taught is typically information giving, and the way students are examined is typically information reproduction. There is a feeling that this method should be replaced and a method whereby teaching concepts in sciences be encouraged. The main obstacle coming in the way is the examination system which is being used to screen students for one purpose or the other; may be for selecting students for courses where there is large demand like in engineering and medicine or may be for employment selection. As indicated in earlier
paras, there are some specific attempts by organisations like Eklavaya, KSSP to provide models for change. However, these need to be replicated for wider impact and benefits.

Acknowledgements:

The author acknowledges the inputs provided by Mr. U.K. Habbu, Prof. Snehlata Shukla, Shri Subir Shukla and Dr. H.K. Dewan of Ed.CIL and its Technical Support Group.
<table>
<thead>
<tr>
<th>No. of Institutions (in lakhs)</th>
<th>1950-51</th>
<th>1995-96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Schools (Classes I - V)</td>
<td>2.10</td>
<td>5.90</td>
</tr>
<tr>
<td>Upper Primary Schools</td>
<td>0.13</td>
<td>1.71</td>
</tr>
<tr>
<td>Total</td>
<td>2.23</td>
<td>7.61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of Teachers (in lakhs)</th>
<th>1950-51</th>
<th>1995-96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Schools (Classes I - V)</td>
<td>5.38</td>
<td>17.40</td>
</tr>
<tr>
<td>Upper Primary Schools</td>
<td>0.36</td>
<td>11.65</td>
</tr>
<tr>
<td>Total</td>
<td>5.74</td>
<td>29.05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gross Enrolment</th>
<th>1950-51</th>
<th>1995-96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Stage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Enrolment (in Millions)</td>
<td>19.2</td>
<td>109.8</td>
</tr>
<tr>
<td>Gross Enrolment Ratio (Percentage)</td>
<td>43.1</td>
<td>104.3</td>
</tr>
<tr>
<td>Upper Primary Stage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Enrolment (in Millions)</td>
<td>3.1</td>
<td>41.0</td>
</tr>
<tr>
<td>Gross Enrolment Ratio (Percentage)</td>
<td>12.0</td>
<td>67.6</td>
</tr>
</tbody>
</table>