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## Science learning at our school stage: Practices, issues and prospects

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### Abstract

Education is one of the potent instruments for the socio economic development of a nation. Science education being an important component of education system contributes to the solution of the national problems through the development of desirable qualities, understanding skills, abilities etc among the people. The place of science in school education has been well established throughout the world. Science education is now a major concern in almost all the developing countries. High priority is given to its quantitative expansion and qualitative improvement. Looking at the complex scenario of science education in India, three issues stand out. First science education is still far from achieving the goal of equity enshrined in our constitution. Second science in India even at its best, develops competence but does not encourage inventiveness and creativity. Third overpowering of examination system is basic to most, if not all, the fundamental problems of science education in India. Various programmes have been created worldwide to support science education in developing countries. The present article highlights the practices, issues and prospects of science learning at our school stage.

**Keywords:** Practices of science learning, reformative strategies, future prospects of science learning

### Introduction

Education plays a pivotal role to mould the personality of any individual. One of the major tasks of education is to help children to develop skills appropriate to their age. Education is the process of developing the capacities and potentialities of the individual, so as to prepare that individual to be successful in society.

Education system as a whole is expected to prepare younger generation to adopt better way of life in the dynamic society. It is a process where one is trained to understand and fulfill the roles expected from him/her. The goal of education is to create an individual who is capable of doing new things with inquisitive mind. A good system of education should contribute to the physical, social, emotional and intellectual development of the individual. All educational processes appearing in formal, and non formal contexts aim at all round development of children. Education is one of the potent instruments for the socio-economic development of a nation. Science education being an important component of the education system contributes in the solution of the national problems through developing skills, abilities etc. among the people. In contemporary age science has become very much relevant to meet the needs and aspirations of the people. However, till the end of 18<sup>th</sup> century, science teaching was badly neglected and it had hardly any place in school curriculum. With major scientific discharges in the Eighteenth and beginning of Nineteenth centuries followed by popularization of science, the importance of science in school and college curricula was realized in Europe and many other parts of the world. Now the place of science in school education has been well established throughout the world. In India now science is offered as a part of general education up to ten years of schooling. Current educational reform proposals are constantly advocating for the introduction of technology in the education of all students up to ten years of schooling.

The University Education Commission (1948-49) recommended that science education should be a part of general education from primary to under graduate education.

The report of the Secondary Education Commission (1952-53) recommended the teaching of general science as a compulsory subject in the high and higher secondary school.

Indian Education Commission (1964-66) recommended that science education should become an integral part of school education with provision for compulsory teaching of

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science and mathematics to all its pupils as a part of general education during the first ten years of schooling. Further, it noted that science should be linked to agriculture in rural areas and technology in the urban areas.

National Policy of Education, 1968 gave much greater attention to science and technology and in the school curricula, science and mathematics were incorporated as compulsory subjects.

National Policy of Education, 1986 has reiterated the importance of Mathematics and Science Education in schools as well as inculcation of scientific temper among the children in schools.

National Policy of Education (1992) has stated specially about strengthening of science education and the relationship of science with health, agriculture, industry and other aspects of daily life.

The National Curriculum Framework (NCERT, 2000) suggested that instead of science, science and technology should be taught at the school level. It observes science and technology should be relevant and should meet the social needs.

### **Practices of science learning at our school stage**

Mahatma Gandhi said “By education I mean an all round drawing out of the best in child and man - body, mind and spirit”. Science education is no exception to this. In 1958, the Govt. of India adopted a Science Policy Resolution according to which science was an instrument of economic development and had a far reaching cultural role in transforming the attitudes and outlook of the people, by creating a scientific temper. With the passage of time, science education is becoming more and more a concern not only of the central agencies like NCERT, but of scientists, educationists, industrialists and society as well. However, our country with a large number of population and diversified cultural, social and economic backgrounds is yet to develop quality of science education programmes which can reach the masses and improve their quality of life significantly.

Now a days, science learning has occupied a significant aspect of our school education. It is included in curriculum of pre-primary school stage to high/ higher school stage in the way or other.

**Pre Primary Stage:** In India, pre school education is provided by private schools and government centers. In addition, there are ECCE (Early Childhood Care and Education) Centers running under SSA. Various types of pre primary schools are available in India. Some of them are Kindergarten school, Montessori school, Nursery school, Pre basic school. Apart from these, there are also pre-primary schools like Balbhavan, Balwadis, Balsevika, Anganwadi etc. established by the government under the ‘Integrated Child Development Scheme’. Formal teaching of subjects and reading and writing are prohibited at this stage. At this stage, awareness of the environment and child’s perspective towards self, school, family, cleanliness, manners, birds, animals, water, our helpers, seasons etc. is highly emphasised. Children should be provided with ample opportunities for developing essential skills of identification, comparison, matching, naming, seriation, drawing and counting without subjecting them to formal ways of learning numbers etc.

In the early primary stage (classes I to V), science is taught as environmental studies; in classes I and II as a composite course including both the natural and the social environment, and later on, in classes III, IV and V, as two subjects – environmental studies I (natural science) and environmental studies II (social science). Since the environment and the experiences of the children outside the school vary from place to place, the activities provided in the school should also vary so that edifice of knowledge is built not on abstract concepts but also on the solid foundations of experience drawn from the environment of the child.

In the upper primary stage (Classes VI to VIII) physical and life sciences is introduced. At the same time, environmental education, nutrition, health and population education received adequate attention so that science is related meaningfully to life.

**At secondary level (IX, X)** there are no separate textbooks of physics, chemistry, and biology. There are two science texts, one for class - IX and other for class - X.

At the higher secondary stage (classes XI and XII) science is introduced as a separate discipline. At this stage, physics, chemistry and biology are taught as independent subjects. Emphasis is laid on experiments/ technology and problem solving.

In the higher education system in India there are three principal levels of qualification. These are: Bachelor/ Under graduate level, Master’s/ Post graduate level, Doctoral/ Pre-doctoral level.

**Bachelor’s Degree:** Students in bachelor level education are admitted after 12 years of school education. Bachelor degrees in science, arts and commerce require three years education. In some places there are honours and special courses available. Bachelor degrees in professional field of study of agriculture, dentistry, engineering, pharmacy, technology, veterinary and medicine generally take five years and five-and-a-half years responsibility.

**Master’s Degree:** Master’s degree is normally of two years duration. It is either based on course work without a thesis or based on research alone.

**Master of philosophy (M Phil):** This is a pre-doctoral programme, which is taken after completion of Master’s Degree. This can either be completely research based or can include course work as well. PhDs are awarded two years after the M. Phil or three years after the Master’s Degree (although it generally takes longer).

**Diploma courses:** These are also available at the under graduate level and post graduate level.

### **Issues of science learning**

Science education is now a major concern in almost all the developing countries. High priority is accorded to its quantitative expansion and qualitative improvement. Teaching of science not only makes students ready for many professions but also gives training in scientific methods. It trains the students in attacking problems in systematic fashion. This knowledge is applied to solve other problems arising in new situations. Further science teaching promotes scientific attitudes, which involves critical observations,

open mindedness, free from superstition and false belief etc. The attitude once developed is useful in later life of children.

### **Some of the pressing problems facing india with regard to science education can be summarized as follows**

Lewin, Stuart (1991) <sup>[12]</sup> states that developing countries introduces various programmes to support the development of science education at secondary and higher education levels. Much has been achieved and number of students enrolled in science courses has increased almost everywhere. However, expectations have rarely been met and lack of science trained personal at high and middle levels continues to hamper the socio-economic development of many countries. As a result, science education in a large number of countries is still in a critical state.

Rani (1997) <sup>[15]</sup> made a study of problems of science education and attitude of students towards science in high schools of East Khasi Hills district, Meghalaya, and found that there existed an acute shortage of qualified and trained science teachers in rural areas and majority of the rural science teachers were found to be ignorant of the objectives of science teaching. Some of the pressing problems facing India with regard to Science education are as follows:

- The shortage of qualified teachers
- The attitude, approach, criteria and yardsticks adopted to assess and evaluate performances in the field of science are woefully inadequate
- Science is not properly connected to other subjects
- Students just have bookish knowledge
- Laboratories are just an eye wash in some schools and in others they do not even exist
- Curriculum is not flexible
- Teachers are still dominated by the lecture method
- There is a lot of gap between theory and practical
- Science is not related to daily life of students
- Spirit of investigation is not at all encouraged
- Learning by doing is still a slogan packed in the books
- Good text books written on modern lines are not available
- Methods of teaching are old and worn out
- Equipment in laboratory is not sufficient
- Individual attention is not paid
- Hobbies do not find their proper place.

### **Prospects/ future prospects of science learning**

Science acts as a powerful tool for human and social development. It has entered our daily life and activities so much so that our existence has become impossible without it. The fast development in agriculture, industry, environment, health care, defense etc. has been achieved because of fast growth of science. It has helped to make life more comfortable and improved the standard of living.

Schooling of a child in India usually starts at the age of 5-6 and it continues up to the age of 14. After class 10<sup>th</sup>, a student may choose any of the available streams. In class 11<sup>th</sup> and 12<sup>th</sup> those who take science learn the basics of applied physics, applied chemistry, Plant and Animal Biology and/or Higher Maths. After completion of class 12, one can either take the conventional way i.e. do courses such as B.Sc. and M.Sc. or can opt for a professional course such as B Tech. and MBBS.

Some more careers that one may opt are B Arch, BAMS (Bachelor in Ayurvedic Medicine), B.Sc. Nursing, B.Sc. Anthropology, B. Pharma, B.Sc Occupational Therapy, B.Sc. Physical Therapy, B.Sc. Zoology, B.Sc. Biochemistry, B.Sc. Botany, Graduation in Microbiology, B.Sc. Biomedical Science, Biotechnology, B.Sc. Computer science, B.Sc. Electronics, B.Sc. Physics, B.Sc. Chemistry, B.Sc. Polymer Science. In addition to the above mentioned careers some other careers that one can pursue after taking up science in higher secondary are Agricultural education, Aqua Science, Astronomy, Bioinformatics, Biostatistics, Environmental science, Forensic science, Food technology or food tech, Geology, Horticulture, Home science, Meteorology, Molecular Biology, Oceanography, Plant pathology, Physical science, The science of phonetics.

Post graduate education in India is of 2-3 years. Post Graduate stages of courses are known as Masters Courses or Doctorate courses. Masters courses are usually of 2 years duration and Doctorate (research) courses are of 3 years duration. PG education caters largely to a specific field or sub field of any preferred discipline. Thus, one can specialize in any of preferred subjects at this level. Those who are interested in conducting large amount of research work pursue these courses.

### **Reformative strategies for better science learning**

The latest reforms implemented in India are listed below:

- Connecting knowledge to life outside the school
- Ensuring that learning is shifted away from rote methods
- Enriching the curriculum to provide for overall development of children rather than remain textbook centric
- Making examinations more flexible and integrated into classroom life
- Science teaching should be placed in wider context of children's environment to equip them with the requisite knowledge and skills to enter the world of work
- Context, process and language of science teaching must be commensurate with the learner's age range and cognitive reach
- Science teaching should engage the learners in acquiring methods and processes that will nurture their curiosity and creativity, particularly in relation to the environment.
- Awareness of environment concerns must be permeate the entire school curriculum
- Teachers can devise activities, projects and studies, both drawing from textbooks and going beyond them to encourage children to explore, investigate, and construct knowledge.
- Oral testing and group work evaluation should be encouraged
- Classroom should be brightened with adequate natural light inside and then made lively by displaying children's work on the classroom well as in different parts of the school.
- Science is to be developed as discipline of mind instead of dead information
- Good text books should be written
- Financial help should be provided to the schools so that the required equipment can be purchased
- Individual attention to students should be paid

- In-service training, summer institutes, refresher courses, work shop etc should be popularized
- Information and communication technology (ICT) should be used
- A large-scale science and technology fair at the national level can be organized to encourage schools and teachers to participate in this movement.
- For teaching of science the school should have basic infrastructure such as small laboratories, display room/museum, garden etc.
- In order to overcome problem of science equipment/material which are essential for science teaching, it is necessary to develop low cost material looking into the curricular needs and local resources.
- Inviting parents and community members to share their knowledge and experiences in relation to a particular topic being studied.
- Total study time that is expected from students in both face to face and self-study and home work needs to be accounted for while planning the syllabus or courses of study for students, especially as they go into longer grades.
- Teacher's autonomy and professional independence must be ensured.
- In order to improve the validity of current examination, the entire process of examination, the entire process of paper setting needs to be overhauled and the focus should shift to framing good questions rather than mere paper setting.
- Since scientific method involves several interconnected steps; therefore in this increasingly fast changing world the different imperatives like flexibility, innovation and creativity have to be kept in mind in shaping science education and the science curriculum at different stages of school education should be fixed accordingly.
- Excellence in science education requires improvement in well-crafted courses, e-learning materials.

### Conclusion

Science education in developing countries is a fundamental issue to improve the economic growth and the living standard of the countries. In the second half of the 20<sup>th</sup> century, various programs have been created worldwide to support the science education in these countries. Many of the programs, however turned out to play the role only to emphasize the importance of science education in developing countries. Science has been accepted as a foundation of advanced technology and for understanding of nature. Scientific methodology could enhance our mode of thinking and way of life. Improving science education is part of a systematic education reform. Within the larger education system, science education can be viewed as a subsystem with both shared and unique components. The components include students; teachers; schools with principals, policy makers; teacher education program in colleges and universities; textbook publishers; communities and parents of students; scientists and engineers; science museums; business and industry; and legislators. Science is an endless quest and increasing exploration of nature and natural laws, where as the technology is the application of this understanding to make human life healthy, happy etc. This nature of science and technology must get reflected in the teaching of science. However in the present system, exploration and experimentation have become extinct.

Students learn science either from the blackboards or from books and not by participating in science or by doing science. Curiosity of children which is normally in born is dampened at every moment. Our students emerge from schools and colleges devoid of creativity and innovativeness and frightful of their future. This must change and change early to make common men and women science and technology friendly to make school and college students curious, excited, innovative and creative, self confident, ready to contribute to this great kingdom of objectivity namely science and to the powerful instrument of development namely technology.

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