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CHAPTER – II

Theoretical Framework of the Study

2.1 Introduction:

Education has always been accorded an honoured place in Indian society. The great leaders of the Indian freedom movement realized the fundamental role of education and throughout the nation’s struggle for independence, stressed its unique significance for national development. Gandhiji formulated the scheme of basic education seeking to harmonize intellectual and manual work. This was a great step forward in making education directly relevant to the life of the people. Many other national leaders likewise made important contributions to national education before independence.

In the post-independence period, a major concern of the Government of India and of the states has been to give increasing attention to education as a factor vital to national progress and security. Problems of educational reconstruction were reviewed by several commissions and committees, notably the University Education Commission (1948-49) and the Secondary Education Commission (1952-53). Some steps to implement the recommendations of these commissions were taken; and with the passing of the Resolution of Scientific Policy under the leadership of Jawaharlal Nehru, the development of science, technology and scientific research received special emphasis. Toward the end of the third five year plan, a need was felt to hold a comprehensive review of the educational system with a view to initiating a fresh and more determined effort at educational reconstruction; and the Education Commission (1964-66) was appointed to advise the Government on “the national pattern of education and on the general principles and policies for the development of education at all stages and in all aspects”. The report of the Education Commission has since been widely discussed and commented upon. The Government is happy to note that a general consensus on the national policy on education has emerged in the course of these discussions.

The Government of India is convinced that a radical reconstruction of education on the broad lines recommended by the Education Commission is essential for economic and cultural development of the country, for national integration and for realizing the
ideal of a socialistic pattern of society. This will involve a transformation of the system to relate it more closely to the life of the people; a continuous effort to expand educational opportunity; a sustained and intensive effort to raise the quality of education at all stages; an emphasis on the development of science and technology and the cultivation of moral and social values. The educational system must produce young men and women of character and ability committed to national service and development. Only then will education be able to play its vital role in promoting national progress, creating a sense of common citizenship and culture and strengthening national integration. This is necessary if the country is to attain its rightful place in the comity of nations in conformity with its great cultural heritage and its unique potentialities.

The Government of India accordingly resolves to promote the development of education in the country in accordance with the following principles:

(i) Free and Compulsory Education:
(ii) Status, Emoluments and Education of Teachers:
(iii) Development of Languages:
(iv) Equalization of Educational Opportunity:
(v) Identification of Talent:
(vi) Work-Experience and National Service:
(vii) Science Education and Research:

With a view to accelerating the growth of the national economy, science education, and research should receive high priority. Science and mathematics should be an integral part of general education till the end of the school stage.

(viii) Education for Agricultural and Industry:
(ix) Production of Books:
(x) Examinations:
(xi) Secondary Education:

Education opportunity at the secondary (and higher) level is a major instrument of social change and transformation. Facilities for secondary education should accordingly be extended expeditiously to areas and classes which have been denied these in the past. There is a need to increase facilities for technical and vocational education at this stage. Provision of facilities for secondary and vocational education should conform broadly to
requirements of the developing economy and real employment opportunities. Such linkage is necessary to make technical and vocational education at the secondary stage effectively terminal. Facilities for technical and vocational education should be suitably diversified to cover a large number of fields such as agriculture, industry, trade and commerce, medicine and public health, home managements, arts and crafts, secretarial training etc.

(xii) University Education:
(xiii) Part-time Education and Correspondence Courses:
(xiv) Spread of Literacy and Adult Education:
(xv) Games and Sports:
(xvi) Education of Minorities:
(xvii) The Educational structure:

The Government of India recognizes that reconstruction of education is no easy task. Not only are the resources scarce but the problems are exceedingly complex. Considering the key role which education, science and research play in developing the material and human resources of the country, the Government of India will, in addition to undertaking programmes in the Central sector, assist the state governments for the developments of programmes of national importance where coordinated action on the part of the states and the Centres is called for. The Government of India will also review, every five years; the progress made and recommends guidelines for future development.

2.1.1 General framework:

Indian schools follow an education system that has its genesis in the recommendations of an Education Commission appointed by the government in the year 1964. The first ten years of schooling are devoted to eight years of elementary education comprising five years of primary (class I – V) and three years of upper primary (class VI – VIII) education, followed by two years of secondary (class IX – X) education. The students then undergo two years of higher secondary (class XI – XII) education to complete school. This format is popularly referred to as the ‘10+2 pattern’ of education.

The Indian Parliament adopted the recommendations of the Education Commission as its National Policy on Education (NPE) in the year 1968. The highlight of the recommendations was that science and mathematics were, for the first time, made
subjects for compulsory study for all pupils as part of general education during the first
ten years of schooling. In this context, the commission went on to recommend that:

(i) In the lower primary classes, science teaching should be related to the child’s
environment. The Roman alphabet should be taught in class IV to facilitate understanding
of internationally accepted symbols of scientific measurement and the use of maps, charts
and statistical tables.

(ii) At the higher primary stage, emphasis should be on the acquisition of knowledge and
the ability to think logically to draw conclusions and to make decisions at a higher level.
A disciplinary approach to the teaching of science will be more effective than the general
science approach.

(iii) A science corner in lower primary schools and a laboratory-cum-lecture room in
higher primary schools are minimum essential requirements.

(iv) At the lower secondary stage, science, taught in terms of disciplines like chemistry
and biology, would help students to grasp the distinct pursuits possible within the broader
spectrum comprising ‘science’. Such an approach would pay long-term dividends in this
age of super-specialties. Experimental approach to the learning of science should,
moreover, be stressed.

(v) Science courses at an advanced level may be provided for talented students in selected
lower secondary schools along with the necessary facilities of staff and laboratory.

(vi) Science teaching should be linked to agriculture in rural areas and to technology in
urban areas. But the levels of attainment and avenues to higher education should be the
same in both types of schools.

A national curriculum framework was designed in 1975 to translate the avowed
policy into action. It was suggested that at the secondary stage, the science syllabus could
be bifurcated under the titles physical science, covering physics and chemistry and the
life sciences, covering botany, zoology and human physiology. An alternative was to
offer science as a single integrated subject where concepts are developed as units without
violating the parameters of the various disciplines. At the senior secondary stage,
however, science could be offered as ‘discipline-wise’ courses in the academic stream.

The new curriculum elicited the criticism that the content of the science and
mathematics courses prescribed for classes IX and X were inordinately taxing on the
students. In June 1977, a review committee under the chairmanship of Ishwarbhai J. Patel was appointed to examine the syllabus and textbooks recommended by the National Council of Educational Research and Training (NCERT). The committee suggested the restructuring of the scientific concepts taught in classes IX and X. The members also proposed that students be given the option of choosing from two equivalent courses in the secondary stage. The first alternative was to offer the study of science as a single subject encompassing its various disciplines, while the second alternative was to offer a discipline-wise science course consisting of biology, chemistry and physics etc.

Schools affiliated to the Central Board of Secondary Education (CBSE) gave their students an opportunity to pick a course of their choice from these alternatives. The authorities, however, soon realized that the two courses were not being perceived as constituting a choice between equally rewarding options. It was observed that students who had opted to take the ‘discipline-wise’ science course received preferential treatment while securing admission to the higher secondary stage. Thus the spirit underlying the review committee’s recommendations was practically undermined. The CBSE schools therefore abandoned these initiatives and returned to ‘discipline-wise’ study of science at the secondary stage, as was the practice in all other schools.

2.1.2 National policy on Education, 1986:

A new educational policy was developed in 1986, nearly eighteen years after the NPE was formulated and implemented. Fresh assessment was necessitated by widespread belief that the system in prevalence neither met the needs nor fulfilled the aspirations of the people. The 1986 policy reposed faith in the conviction of its predecessors that science and mathematics should continue as compulsory subjects in the first ten years of school education. Indeed, the teaching of science needed to be further perfected as virtually all aspects of growth and development in the modern era had their basis in scientific knowledge and as such, societies needed citizens literate in science and technology at various levels to ensure overall progress. Towards this end, the policy further enunciates:

(i) Science and mathematics will remain as core subjects in the first ten years of school education.
(ii) In order to develop scientific temper and to attain other goals, it is necessary to define the objectives to be fulfilled through science education.

(iii) To attain universal enrolment and to pre-empt dropouts, improvement in both the environment as well as the quality of education imparted are to be treated as a quintessential ongoing process. The learning process, being neither uniform nor mechanical, allowances need be made for individual students who may differ from the majority. Teaching and learning of science should be so designed as to respect the basic rights of each and every student. Science education at the elementary level should not overwhelm children with loads of information but should instead aim to open their hearts and minds to the joy of learning.

(iv) Science education will be extended to the vast numbers who have remained outside the reach of formal education. This is to be borne in mind while planning for non-formal systems.

(v) Science and mathematics curricula for the secondary level should help inspire conscious internalization of a healthy work ethos. This will provide valuable manpower fuelling economic growth even while moulding ideal citizens who can adapt effortlessly to a society based on science and technology.

(vi) Science curriculum for general education will be implemented in pace-setting schools with sufficient scope for innovation and experimentation.

(vii) Science up to class X should be treated as a combined subject. The laws and principles of science, operating in the environment, should be used for creating desired teaching / learning situations. The learning and teaching of science should be so prioritized as to lay greater emphasis on an activity-oriented methodology.

Before discussion on science education it is necessary to explain the present scenario of the existing school system of the country. India is a large country of more than 100 million people speaking 16 major languages. A Central Govt. and a Government in each State are responsible for the administration. Education is in the concurrent list, but basically is under the control of the States. At the school level, the nation is attempting to implement the recommendations of the Kothari Commission’s Report (1964) and 10+2 curriculum has been introduced. Two National Policies of Education (1968 & 1986) and one review committee report (1977) have provided the necessary
guidelines. First ten year’s general education may be divided into first eight years
elementary education (5 years primary followed by 3 years of upper primary) and next 2
years secondary education. Science, mathematics, social science together with three
languages, work experience, art and physical education are compulsory for all students in
the ten year general education. The plus two stages include academic and vocational
streams. The students in the academic stream opt for either arts or science or commerce.

At the State level the first 5 years primary education is under the control of the
Directorates of Education. From upper primary (classes VI to VIII) and secondary (IX to
X), the academic control lies with the Boards of Secondary Education. The plus two stage
is looked after in most states by the Boards of Higher Secondary Council/Intermediate
Board. Both the Secondary and Senior Secondary Institutions are under the
administrative control of the Directorates of Education, which look after the physical
facilities, appointments, transfer and inspection of the teachers. In order to advice and
assist the State Council/Institute of Educational Research and Training (SCERT or
SIERT).

These bodies work mainly for the elementary education and depending upon the
availability of resources also work for Secondary and Senior Secondary levels. There are
nearly 631394 primary schools, nearly 138687 upper primary, 52208 secondary and
15498 senior secondary schools (science offered in 10608). In spite of improvement in
recent years the school education is still the victim of problems like non-enrolment, drop-
out, over crowding, shortage of properly qualified and trained teachers and poor physical
facilities, government of India has introduced several projects to bring quick results at the
level of elementary education, science and mathematics education, vocational education,
non-formal education etc. In all matters of school education, Government of India is
advised and assisted by an autonomous body like National Council of Educational
Research and Training (NCERT).

From the sixties of last century, a new wave came all over the world to strengthen
science education. This was considered a must to live effectively in the science and
technology based society, which needs experts, middle order workers and above all
scientifically literate citizens. The existing mechanism of science education was found to
be inadequate in the face of problems created by knowledge explosion and population
explosion. The number of citizens to be trained was increasing every year together with the rise of the quantum of information to be communicated. The developing countries had the additional burden of clearing the backlog of illiteracy and economic upliftment. The integrated science curriculum came as a course to teach science in this situation.

In the beginning, it was thought that integrated science is joining of several subjects into a single course in which concepts of science are presented through a unified approach (Rutherford, 1978). In 1989, it included “topics such as science, society and technology and a variety of matters of concern to any science educators” (Reay, 1989). The contents and formats varied widely and integrated science has been attempted for different levels primary, secondary, higher, vocational and teacher education. Three levels of intensity of integration have been noted Coordination, Combination and Amalgamation (Blum, 1973). Without going to make any qualitative rating or presenting some data about the uptake of different integrated science curricula, Haggis and Aday (1978), identified the following trends of integrated science education:

(i) Integrated science is a rapidly developing and expanding educational facility,
(ii) There is a worldwide movement to introduce science into primary school education,
(iii) There is a rapid and wide spread development of integrated science education at the lower secondary level,
(iv) Much greater attention is now being held to the training and retraining of teachers for integrated science,
(v) There is a trend towards greater social relevance in integrated science courses,
(vi) An emphasis is now being placed on environmental issues in integrated science courses,
(vii) Integrated science courses in science and technology education are now being developed,
(viii) The scope of integrated science course is now being extended,
(ix) Attempts are being made to inter-relate integrated science courses with other curriculum areas and
(x) Much more attention is being given to evaluation in science education.
2.1.3 Science Education Today:

In spite of all efforts of our policy makers, national leaders and educationists, science teaching-learning system or science education as a whole appear a bit gloomy even after sixty four years of independence. Starting from Indian school education in science, under graduate / postgraduate teaching and research, level of quality in basic science is not very encouraging in comparison to global standard. Even in the different states of India, uniformity is lacking in all aspects. Quantitative growth has been achieved as evidenced by existing more than million primary and secondary schools, around 2000 professional institutes, around 2000 training institutes, more than 20,000 general colleges and 400 universities which are ready to accommodate eligible candidates at suitable stages. Infrastructural facilities available for science teaching are not uniform in the schools where three distinct categories can be identified. The categories are government aided, government administered and under total private management. Of these three, the third one, i.e. the private schools provide best facilities for science teaching-learning system in the form of qualified teachers, well equipped laboratories, libraries, computer facilities etc. In addition to all these, professional approach of the school management helps the students to prepare themselves for the tough competition in educational market. Other schools, i.e. government and aided schools somehow manage their systems because of the limitations of varied nature.

Funding is often posed as a major constrain which can not be denied. Inadequate financial support from the funding agencies forces the institution not only to restrict up gradation of their laboratories, but also limit the maintenance cost of the existing instruments and technical equipments in use. In addition, the institutes are facing enormous problems to run the practical classes of students in subjects like chemistry, biology, environment science because of gradual hiking of prices of chemicals, fuels, glass goods and such other consumables. Modernization and up gradation of these labs are often proposed in the development schemes submitted at the appropriate levels by the concerned persons as a routine work. But nobody knows when the scope of implementation will come.

When our area of discussion is science education in Indian subcontinent, ‘manpower’ issue is to be considered simultaneously with non-living infrastructural
facilities. Starting from school to the universities level, standard of teaching and research mainly depend on the strength of faculty and support staff. The word ‘strength’ does not qualify a numerical figure only; it stands for ‘quality’ also. To be more precise, quality of manpower truly influence quality of teaching at any level and quality of research in any area. This is the most important requirement the nation desires to have from the intellectual people for its steady development. Unfortunately except a few dedicated academicians, most of our science teachers and researchers think otherwise. To them, taking a number of classes per week or publication of a number of research papers and award of a few Ph.D. degrees will serve the purpose. They do not care to think whether delivery of a few monotonous lectures effectively lead to learning or enrichment of knowledge bank of the students and papers published after working out traditional research problems will be of any use to satisfy national development requirements or fulfill societal needs. Casual approach of institutional teachers at any level influenced rise of a parallel system of education in the name of private tuition. Standing on a solid platform, this parallel system has gained not only tremendous momentum but also proved its effectively as an efficient students support system to such an extent that students of schools and colleges attend these coaching centres even when they are supposed to attend their theory and / or practical classes in regular institutes. Leaving apart a few exceptional institutions, success of this parallel education system can not be denied.

2.1.4 Who is Responsible?

If we throw a question regarding the above stated problem in a gathering of academicians, nobody will come forward to answer the question for obvious reasons. In stead, they may point their fingers to the concerned government or educational policymakers. In my opinion, neither the entire government nor the concerned ministry of state and / or centre can be held solely responsible for this undesirable poor condition of science education in India. It is simple a reflection of the outcome of activities of different educational thinkers, planners, policy makers and activists who are responsible members of our academic fraternity. To be more precise, we the academicians are mostly responsible for deterioration of teaching and research in science education. The reasons behind are very clear and transparent: in this rapidly changing knowledge era when ‘explosion of knowledge’ and ‘obsolescence of knowledge’ are alternating each other in
cyclic manner, we have misplaced our priorities for improvement of science education. Knowing our deficiencies fully well, we have taken least active interest to rectify those. Science teaching at schools followed more or less the same traditional system. Nature of course structure, content, examination pattern and marks weightage changed from time to time. But the required balance of teaching load at different stages and maintenance of links from one level to the next higher one was not judiciously taken care of. Repetition of topics at different stages, stereotype teaching methods and lack of sufficient practical training have made the teaching–learning system lifeless and monotonous.

Science teaching and research at higher education level would have been more dynamic and improved if suggestions of Dr. M.N. Saha and Dr. H.J. Bhaba were accepted and implemented for improvement of science and technology education. In late fifties and early sixties, the then Prime Minister of India appreciated the suggestions but was unable to consider those during implementation of science policies. Scientific Advisory Committee to the Cabinet (SACC) played a mechanical role and failed to warn the academicians about the deteriorating university science education. In spite of the fact that we still have students of outstanding merit and brilliant research workers, our ranking in terms of number of publication, of research papers has fallen down from 8th in 1980 to 13th in 1990 and there from to 21st in the new millennium. In terms of “quality” of publication, our ranking came down to 119 as recorded in Science Citation Index. It is true that we have limitations in comparison to other developed countries. But that do not justify our poor performance in the field of higher education. Many of our eminent scientists and academicians have pointed out our drawbacks and lacunae in educational policies. But the persons responsible for implementation of the decision taken by different bodies ignored their suggestions, India being one of the front liners amongst the large scientific manpower in the world, have failed to evaluate its own performance in time so that scope for rectification can be availed of.

Standing on the 21st century we have no other alternative but to energies ourselves to work as active soldiers of science education movement. We do not have any deficiency in merit, general capability or skill. In stead we are deficient in strong determination, commitment and farsightedness. After accepting the concept of globalization, we have to go for development of ‘quality manpower’ that will be entrusted to transfer quality
education to the deserving students. As science forms the backbone of technology, we have to consolidate science education from the school level so that best technologist emerges out in future from higher education institutes. Our researchers in science and technology should remember that demand of ‘quality research’ is not for Ph.D. award and publication of few papers only. Output of research must be used as teaching inputs and as raw materials for national development. In this knowledge era, if we fail to recognize and accept the new knowledge from the global scientific arena we will be automatically thrown back beyond the starting point. Let there be no further delay in taking urgent measures to improve science education at all levels so that its benefits can percolate immediately to different social strata to serve greater interests of humankind around the world.

2.1.5 Education Development:

During the period of national movement detailed discussions were held about the future of Indian education system. National leaders including Gandhiji exhorted the people to boycott the educational institutions of the British. A number of national educational institutions were started during that period. The system of education that Gandhiji suggested for the whole of India is known as Wardha Scheme or Scheme of Basic Education.

The Constitution amendment of 2001 declared that free and compulsory education of children of 6 to 14 years of age is a fundamental right. This is not a sudden change. But an example of importance given to education by the Governments of independent India. The important education commissions appointed in free India for advising on education reform are
(i) The University Education Commission of 1948-49 under the chairmanship of Dr. S. Radhakrishnan.
(ii) The Secondary Education Commission of 1952 under the chairmanship of Lakshmana Swamy Mudaliar.
(iii) The Education Commission of 1964-66 under the chairmanship of Dr. D. S. Kothari.
(iv) The Yashpal Committee under the chairmanship of Prof. Yashpal.

Navodaya schools opened as a part of the New Education Policy introduced in 1986. It was the Kothari Commission report which laid the foundation of this new policy.
The Operation Blackboard scheme which provided for increased facilities in primary education and vocational education were started on the basis of New Education Policy. Media like radio and television began to be used for educational purposes. The State Council of Education Research and Training for promoting research and training in education at the state level and the District Institute of Education and Training in each district were started as a part of the New Education Policy. The commission led by Prof. Yashpal suggested measures for the improvement of the quality of education and simplification of work load. The Minimum Level of Learning (MLL), District Primary Education Programme (DPEP) and the Sarva Siksha Abhiyan (SSA) were programmes devised to make basic changes in the field of primary education in India. In order to control the various sectors of education and formulate policies, several national agencies are functioning in the states which are as follows:

(i) University Grants Commission (UGC).
(ii) National Council of Education Research and Training (NCERT)
(iii) All India Medical Council (AIMC)
(iv) All India Council of Technical Education (AICTE)
(v) National Council for Teacher Education (NCTE)
(vi) All India bar Council (AIBC)
(vii) National Assessment and Accreditation Council (NAAC)

2.2 Historical Development of Science Education in India:

2.2.1 Development of Science Education in India:

“The progress, welfare and security of the nation depend critically on a rapid, planned and sustained growth in the quality and extent of education and research in science and technology”. ------ Kothari Commission (1964-66)

Today the world is facing three major problems of population increase, pollution and poverty. Increasing population and increasing poverty are nullifying the developmental efforts of the developing countries, such as India. Although science and
technology have improved the lot of large number of human beings some of the worst problems of humanity today such as mentioned above have either been brought about or aggravated by science and technology. Education is one of the potent instruments in the development process if it is properly geared for that purpose. Science education being an important component of the education system should contribute in the solution of the problems of the country by developing desirable understanding, skills, abilities and attitudes. The greatest challenge is to “humanize” science i.e. to make it relevant to human needs and aspirations.

The strength of a modern economy depends on the strength of its industry and industrial development in turn depends upon technology, which is upon the application of new scientific knowledge, thus all progress grows out of man’s creative capacities. It has become essential to train and equip men at every level-research workers, engineers, executives, technicians, office workers and manual workers. Long-range planning is no less important. Economist, statisticians and sociologists are the support, now and in the future, of the work of scientists and technicians.

2.2.1.1 Ancient and Medieval Period:

India made a pioneer headway in the field of mathematics, medicine, astronomy, agriculture and architecture till about 600 A.D. The oldest Indian scripture, *Rig-Veda*, which was written about 4000 years ago, refers to physicians and speaks of the healing power of medicinal herbs. The concept of atom and the formation of the world as discussed in *The Vaiseshika*, one of the *Upanishads*, approach the modern western thought. The Sankhya philosophy by Kapila is very much like *Darwinism*. The Upa-Vedas or secondary Vedas discuss various sciences. One of these Upa-Vedas is *Ayur-veda* which consists of six books on surgery, nosology, anatomy, therapeutics, toxicology and supplementary section dealing with various local diseases. Great attention was given to diet. In surgery they attained great proficiency. The *material medica* of the Hindus embraced a vast collection of drugs belonging to the mineral, vegetable and animal kingdoms many of which have been adopted by western physicians. There were colleges and universities of international repute.
From the point of view of methods and techniques of acquiring *scientific knowledge*, there was considerable development and refinement of observation. *Logical analysis* as a tool for refinement of ideas and to arrive at generalizations was also considerably developed. From the point of view of the institutions for acquiring knowledge and continuing the tradition, it may be noticed that they were centered round individuals, who passed on the knowledge and skills to their best disciples only. The result was that most of the scientific knowledge and traditions were lost with the time. The early universities of Takshila and Nalanda could be taken as a first step towards institutionalization of teaching and acquiring knowledge but their character must be fully studied and also the reasons for their disappearance.

In a normal course, the scientific knowledge and the methods and techniques of acquiring it should have led to the next stage of development but unfortunately this did not happen. The philosophy of Buddhism (between 750 A.D. to 1000 A.D.) discouraged further development of life sciences. Rules of caste became stricter and Brahmins forbade contaminating with blood and withdrew from all practice of medicine. They even shrank from touching dead bodies and as a result of the decreasing number of good physicians public hospitals had to be closed. Later, on the gradual conquest of the country by invaders from West Asia and Central Asia brought an element of discontinuity of the ancient Indian tradition. The People brought with them different languages i.e. Arabic, Turkish and Persian and also scientific knowledge, methods, techniques and concepts. There is, however, some evidence to suggest that many of the scientific ideas brought to India by foreigners during the medieval period had the Indian origin. A large number of scholars went out of India and were patronized at the courts of various feudal kings in West Asia and Central Asia. The information, methods, techniques and concepts which they took with them were synthesized and incorporated in the medieval Arabic and Persian scientific traditions of West Asia and Central Asia. This was further developed as a part of the scientific and intellectual developments of these civilizations, the form in which they came to India. There is, however, still a controversy on the origin of many scientific ideas, concepts, methodology and techniques and further studies need to be made before we can fully understand the evolution of scientific thought in medieval India.
2.2.1.2 Modern Period:

The modern period brings another sharp break in the scientific thought and tradition of India with conquest of the country by the British. Modern science was introduced in India along with the British, in opposition to the earlier two traditions and again in a foreign language i.e. English. Modern science came to India at a stage of development which marks a radical change from the medieval and ancient sciences, newer branches of science had been developed, experimentation developed as a full-fledged technique of acquiring information. Language of science had taken a definite shape, scientific institutions had been developed and technology made a decisive breakthrough.

Modern science did not make significant headway in India during the British period for various reasons. Its character was not radically different from the earlier scientific tradition in the country but the new language made the process of its assimilation in Indian culture difficult. Secondly, it either aroused awe or hostility as ‘a British Thing’ alien and hostile to the Indian tradition. The effort, therefore, become once again, one of choice rather than of a synthesis to evolve a scientific tradition in the Indian context.

As a result of the alien language whose knowledge was limited to a small group associated with the rulers and the hostile attitude of the general public towards anything which was ‘British’, the new knowledge and information of science could not reach the artisans and craftsmen to make an impact on their trades and crafts, to help them come out of their stagnation and improve upon their old industries. The social and intellectual dialogue could not take place in a sufficiently large scale to make a breakthrough in the scientific outlook of the people. The result was that India remained far behind in scientific and technological development as compared to countries in the West.

In order to study the development of science education in India during the modern period, we have to look to the history of science in the West because whatever happened there was followed in India though at a slower pace.

At the end of 18th century the Universities sadly neglected the teaching of science and it had no place in the school curriculum. Chief scientific discoveries were made by amateurs such as Cavendish, Priestly, James Watt and Hershel. A number of
philosophical societies were started to fill the gap between the educational provision and social need, such as Society of Arts, London, Literary and Philosophical Society of Manchester founded in 1781 and Lunar Society of Birmingham (1766). These societies did remarkable work for popularizing science among the general public. In 1799, Rumford was influential in founding the Royal institute of Great Britain. It was intended for teaching youngmen in the mechanical profession by courses of philosophical lectures and experiments on the application of science to common purpose of life. But later, its policy was altogether changed by the influence of Sir, Humphry Davy and of Faraday and this society become the centre of research.

An important event in the history of teaching science commenced with the Mechanic’s Institute of the early nineteenth century. John Anderson was perhaps the first who attempted to give the course of lectures on Experimental Physics. He was, however, convinced of the cultural possibilities of science teaching. Eventually, in 1823 Glasgow Mechanics Institute was established which was raised to Technical College in 1866. Many other mechanical institutes were started in nineteenth century. In the early part of the nineteenth century many other philosophical societies were at work for the spread of education. By the middle of nineteenth century, however, there were very few schools which were imparting instruction in science. It was in 1847 that first practical chemistry lessons were started by Thomas Hall at City of London School. The centenary of science teaching was celebrated by a large and eminent gathering at the school in 1948.

Most of our knowledge of the state of science teaching in schools is revealed by the reports of Royal Commissions of Education. The commission reported that in none of the schools science was taught to boys who elected to study it instead of languages. They described it as ‘a plain defect and a great practical evil’. They, therefore, suggested that natural science should be taught and should include two main branches, one comprising physics and chemistry and other comparative physiology and natural history. As a result of this, physics was introduced in 1837 at Rugby under Dr. Arnold, Dr.Tait, his successor, introduced botany, chemistry and geology in the curriculum in 1859 and a science lecture room and laboratory were built for the first time at a cost of over £ 1,000.

The great exhibition of 1851 gave a further impetus for teaching science in schools and as a result, a department of science and art was established in 1853. In 1854,
three eminent scientists urged the claims of science as an essential part of general education. *T.H. Huxley* delivered an important address on the educational value of the natural history of sciences; *John Tyndall* lectured on the study of physics as a branch of education; *Faraday* stressed the importance of cultivating a scientific outlook. In 1853 *Faraday* wrote, “As a branch of learning, men are beginning to recognize the right of science to its own particular place, but now the fitness of university degrees in science is under consideration, and many are taking a high view of it, as distinguished from literature, and think that it may well be studied for its own sake, i.e. a proper exercise of human intelligence, able to bring into action and development all powers of the mind.” In 1861, *Herbert Spencer* believed that ‘Knowledge of life was the important knowledge for all moral and physical.’ The most staunch advocate of teaching science in the ‘sixties’ and ‘seventies’ was Huxley. The establishment of natural science course in the Universities of Oxford and Cambridge further paved the way for the inclusion of science in the curriculum of secondary schools. A full survey of the position of science teaching in secondary schools is contained in the *Devonshire Commission Report* published in 1895. The report begins with the discussion on the difficulties attending the introduction of science teaching in the schools and recommended that (i) in all public and endower schools a substantial portion of the time allotted to study be devoted to natural science, and the not less than six hours a week on the average should be assigned for this purpose; (ii) school laboratories should be constructed to supply accommodation for practical work in physics as well as in chemistry. The publication of this report marked the beginning of the widespread introduction of physics and chemistry in the curriculum of boys’ schools and of botany into that of girls’ schools.

Public examination in science and other subjects are of very recent origin. Society of arts of London held science examination in 1852, designed to qualify for membership. In the course of few years the system became established and papers were set in chemistry, physiology, botany, mathematics and mechanics. And for the guidance of candidates the society published a handbook entitled, “*How to Learn and What to Learn*”.

The most outstanding contribution to the history of teaching science in the last quarter of nineteenth century was that of H.E. Armstrong, professor of chemistry in the
Central Technical College, City of Guilds of London Institute. He was very much dissatisfied with the science work in schools and was critical of the teaching method that was adopted. He advocated that all pupils, even beginners, should be allowed to discover things for themselves, and should be placed in the position of the original observers. Later on, this method was known as the Heuristic method. It has been largely modified now. Nevertheless, the Heuristic spirit should permeate the whole of science teaching.

Since the beginning of twentieth century there has been an adequate increase in the equipment and facilities for teaching science in schools. The Great World War of 1914-18 opened the eyes of the general public to the importance of general science in the modern world. Sir J.J.Thomson appointed a committee, in 1916; to inquire into the position of natural science in the educational system and as a result so named ‘Thomson Report’ was published under the title ‘Natural Science in Education’. As a consequence many advanced courses in science were added to many schools. The Science Masters’ Association and the Association of Women Science Teachers were formed in the early century. School Science Review, the S.M.A.Periodical, created a good influence on the teachers as well as the public.

The Wardha Scheme or more popularly known as the Zakir Hussain Committee Report (1938) is the first study of elementary education on a national level. The scheme was the outcome of the educational philosophy of Mahatma Gandhi. The same year, in October, a conference of National Workers was called at Wardha under the presidency of Mahatma Gandhi. This Conference appointed a committee of distinguished educationists under the chairmanship of Dr. Zakir Hussain to prepare a detailed syllabus.

The objectives of general science were ------

(i) To give pupils an intelligent and appreciative outlook on nature.

(ii) To form in the pupils habits of accurate observation and of testing experience by experiment.

(iii) To enable them to understand the important scientific principles exemplified in:

   (a) The natural phenomena around and

   (b) The application of science to the service of man.

(iv) To introduce them to the more important incidents in the lives of the great scientists whose sacrifices in the cause of truth make a powerful appeal to the growing mind.
A committee of the Secondary School Examination Council under the chairmanship of Sir Cyril Norwood was formed. Their recommendations and conclusions were published in 1943, and briefly known as ‘Norwood Report’ contained a chapter dealing with teaching of science. As a consequence of all this the Education Act of 1944 came into force in April, 1945 which has meant an increase in the amount of science taught though not to the extent to which it should have been.

2.2.2. Development of Science Education after Independence:

Before independence, entire education system of India was traditional and conservative. Negligence of British rulers was reflected in all spheres of education including science education. In 1943, Norwood Report was published where a chapter on science teaching was included. Sir Cyril Norwood, Chairman of the Secondary School Examination Council, perhaps visualized the approaching sun rays from independent India and suddenly realized that they should not delay any more to make Indians believe that British rulers were well wishers of India. Within next two years, i.e. in 1945, Education Act of 1944 came into force where recommendations to increase science teaching in Indian schools were incorporated. But the pace of implementation and progress was very slow. Our national leaders fully understood the intention of the British rulers and took suitable measures for early implementation of educational policies in independent India. In spite of all efforts it took about six years when a definite directive was issued in 1953 by the Secondary Education Commission to teach ‘General Science’ as a compulsory subject in high schools. In 1956, first National Seminar on “Teaching of Science in Secondary Schools” was organized at Simla where the participants discussed about different related issues like syllabus, laboratory, equipment, text books, teaching methods etc. to analyse the merits and demerits of the existing system. In India, the pattern of education was influenced by what happened in England; the only difference is that things moved at a much slower pace. Even in the beginning of last century science was not a school subject in our country and it was only in name in the universities. Indian Science Congress was formed a few decades back but it also did not do any notable work towards the teaching of science in schools. That the policy makers of our government had
positive thinking towards improvement of science teaching was evidenced by the following vital steps taken within the next ten years:

(i) In 1957, National Science Policy was adopted by the Central Government. The main objective of this policy was to inspire qualitative improvement of teaching, training and research for development of a healthy scientific community.

(ii) During 1961-62 periods, Indian Parliamentary and Scientific Committee was constituted under the chairmanship of Shri Lal Bahadur Shastri to study the problems and prospects of science education in schools. The terms of reference placed before the committee was to study and analyze the relations between policies and decisions taken by the central and state government at the time of implementation, the existing hurdles in respect of infrastructure, trained and qualified manpower and such others. At this stage National Council of Education Research and Training (NCERT) took its birth as a parent body of National Institutes of Education (NIE) with various departments. Regional Institutes of Education (RIE) at four states like Rajasthan (Ajmeer), Madhya Pradesh (Bhopal), Orissa (Bhubaneswar) and Kerala (Mysore) and also State Institutes of Science Education in different states were constituted. Proposal to introduce ‘Science Education’ (the subject to deal with teaching of science) as a subject was also considered.

(iii) Recommendations of Kothari Commission (1964-66) where improvement of Science Education from primary to research level was stressed upon has been proved to be a timely step at right direction.

(iv) In 1968, National Policy on Education was framed where specific directives were released to declare science and mathematics as compulsory components of syllabi during the first ten years of school.

(v) Two more salient features highlighted in the policy were to ensure application of scientific knowledge and supply of trained manpower to deal with science teaching.

(vi) Involvement of international bodies like UNESCO and UNICEF in upliftment of standard of science teaching in Indian schools was a very effective step taken by the government. In 1963 UNESCO Planning Mission rendered academic assistance by suggesting measures to improve teaching of science and mathematics in secondary schools. UNICEF assisted Science Education Programme (SEP) introduced in 1970 contributed a lot for overall improvement of Science Teaching in classroom situation.
During the last phase of twentieth century educationists and policymakers shifted their focus for educational planning from routine traditional framework to a more dynamic multidimensional pattern to fulfill the needs of 21st century. Nature and flow of that thought current was primarily reflected in the National Education Policy of 1986 and its programme of action (1992) where in addition to the general issues like National Integration, Social Relevance of Education and Science Education was highlighted. Three international conferences, viz., International Conference on Secondary Education (1993), WTO Conference on GATS (1994) and International Conference on Higher Education (1998) held in New Delhi, Uruguay and Paris in three subsequent years served as platforms where directives and guidelines for educational planning relevant for 21st century were chalked out. Cry for quality education and its percolations at all levels were raised. In the year 2000, when educationists looked back, they found that access has been widened but no significant improvement in other points of concern could be noticed except some routine syllabus revision, diversification at will and inter-disciplinary approach without proper co-relation, co-ordination and scope for application. This observation is true for education in general and science education also.

2.2.2.1 Atomic Energy Commission (1948) and Department of Atomic Energy (1954):
India decided to go in for the peaceful application of atomic energy immediately after the cessation of hostilities. An Atomic Energy Commission was set up in 1948 and Development of Atomic Energy under the direct charge of the Prime Minister Jawaharlal Nehru in 1954 was also set up. The organization of research and developmental work, now called the Bhabha atomic Research Centre after the late Homi J. Bhabha is the largest single scientific establishment in the country. The Centre has developed four research reactors which now make available among other things. Radioisotopes for the use in industrial radiography, treatment of diseases, disinfection of food grains, development of high-yielding disease resistant mutants and various other fields. Under its programmes of nuclear power generation, the department has successfully commissioned the Tarapur Atomic Power Station, with an installed capacity of 420 million watts and is on the way to Installing three similar power stations in Rajasthan, Tamil Nadu and Uttar Pradesh.
2.2.2.2 National Science Policy resolution (1957):

The development of science in India was greatly accelerated after independence (August 1947). In 1950 the Government of India appointed a Planning Commission for preparing a blueprint of all-round economic development. In 1954, the Indian Parliament accepted socialism as a political goal. In declaring these objectives, fullest emphasis was laid on the development of science and technology on all fronts. In 1957, the Government took one step further in adopting a National Science Policy Resolution that envisaged the cultivation of science and scientific research in all its aspects, assured an adequate supply, within the country, of research scientists of highest quality through an intensive programmes of training promised the availability of conditions and an atmosphere of academic freedom in which the creative talent of men and women would find full scope in scientific activity. The resolution thus reaffirmed the Government decision to encourage science and develop a healthy scientific community as a sound basis after a balanced economic development.

2.2.2.3 Establishment of the Council of Scientific and Industrial Research (CSIR):

The first major thrust came through the establishment of the Council of Scientific and Industrial Research (CSIR) while the Second World War was still on. Although the councils’ main purpose was to strengthen industrial research; it played an important role after independence towards development of science in general by setting up a series of National Science Laboratories and Research Institutions to cover physical and earth sciences, chemical, biological and engineering sciences, by providing research schemes and fellowships in Universities and Research Institutions and by establishing a publications and Information Directorate and a National Scientific Documentation Centre for the dissemination of Scientific and technical information. The CSIR also pioneered the movement of science museums.

2.2.2.4 Electronics Commission and Department of Electronics:

The importance of electronics in research, industry and technology has been given the due recognition through the creation of an Electronic Commission and a Department of Electronics charged with the responsibility of promoting the electronics industry and
research in India. With the encouragement and financial support from the Department of Electronics and its various agencies, such as the Technology Department Council and the National Radar Council, a number of research institutions, universities and Indian Institutes of Technology are now busy in working out projects relating to material, components, instrument controls, radar, and computers and so on. Active centers have been established in Bombay, Delhi and Kolkata for the development of indigenous computer capability for hardware as well as software.

2.2.2.5 Department of Science: India’s Space Research Organization:

India’s interest in space research has been determined by her requirements of mass communication and education through satellites of survey and management of natural resources by means of remote sensing technology from space platforms and by the need for self-reliance in this new and promising field of scientific research. The India’s Space Research Organization, functioning under the newly created Department of Space, has the responsibility for planning, execution and management of all research activities relating to space.

2.2.2.6 All India Seminars on Teaching of Science:

The All India Seminar on the teaching of science in secondary schools held at Tara Devi (Shimla Hills) in 1956, dealt with almost all the problems facing the inclusion of general science as a core subject for the higher secondary classes. It was the first of its kind which touched almost all the aspects concerning the teaching of science in schools viz. syllabus, equipment and apparatus, method of examination, teaching aids in science and other allied topics like text books, science clubs, museum etc. It had suggested a unique and uniform system of science teaching for the entire country, suited to its needs and resources.

2.2.2.7 National Council of Educational Research and Training (NCERT):

The NCERT was established on September 1, 1961, as an autonomous organization with its headquarters in New Delhi. At the headquarters it has the National Institute of Education (NIE) which is concerned with research, instruction and evaluation. The NIE functions through its various departments like the Department of Education in Science and Mathematics, Department of Education in Social Sciences and Humanities, Department of Educational Psychology and Foundations of Education, Department of
Text Books, Department of School Education, Department of Teacher Education, Department of Teaching Aids, Publication Department and Workshop Department. In addition to the Departments there are units of Library/Documentation, National Science Talent Search, Work Experience/ Vocationalisation, Survey and Data Processing and Examination Reform.

In addition to the NIE, the Council runs four Regional Institutes of Education at Ajmer, Bhopal, Bhubaneswar and Mysore. These Regional Institutes are meant to functions as centres of excellence in the field of teacher education. They organize various types of course such as content-cum-pedagogy course of 4 years duration leading to B.Sc., B.Ed. degrees. They also run one-year B.Ed. course and M.Ed. course. M.Sc. in Science Education course has also been started in these colleges. Besides the regular courses they also organize Summer School-cum-Correspondence Course (SSCCC) for teachers of Secondary Schools.

A Central Science Workshop was also established under the NCERT to produce prototypes of school equipment and to develop low-cost kits for the primary and the middle school stages.

Through the various departments of NIE and the Regional Institutes of Education, the NCERT discharges functions relating to the improvement of education at all levels of school education and teacher training in India. It also functions as the academic wing of the Ministry of Education and Youth Services of the Government of India. It also maintains a close liaison with the Education Departments and the schools in the different States and Union territories of India.

2.2.2.8 State Councils of Educational Research and Training (SCERT) and State Institutes of Science Education (SISE):

Some States have now established State Councils of Educational Research and Training (SCERT) on the pattern of the NCERT. In these States SCERT incorporates the functions of the State Institutes of Education.

SISEs have been set up in all the States with a view to improve the quality of science education in the schools. The main functions of these institutes are to provide in-service training to science teachers in the new developments in the field of science education; prepare instructional materials in science; conduct research studies in science
education of their respective States; provide guidance service in science to school; take up innovative programmes in science education; and participate in the national science programmes.

2.2.2.9 Indian Parliamentary and Scientific Committee (1961-64):

In view of the rapid influence of science on society and of the Government policies, it was felt that both the scientists and the politician should be brought on a common platform to formulate new policies and procedure in accordance with the scientific developments. The Parliamentarians, who are the makers of the policies, must be acquainted with the developments of science and technology and with the scientific viewpoint. As a result of this new ideology, the Indian Parliamentary and Scientific Committee was set up in August, 1961, under the chairmanship of Late Shri Lal Bahadur Shastri. Its primary objectives were to study and examine the problem of ‘Science Education in Schools.’ Science education in the primary schools should be introduced in the form of nature study. Not less than 25% of the lessons in the language readers should be devoted to science subjects in the form of stories, explaining the phenomena in nature as well as the lives of great scientists who have contributed to the making of the modern world. Such lessons should however, not lack in literary presentation and grace to stimulate creative talent of

(1) *Primary stage:*

(a) No differentiation should be made in the curricula for boys and girls at the primary stage.

(b) Women should be appointed on the staff of all primary schools.

(2) *Middle school stage:*

(a) The curriculum of general education should be common to boys and girls and no differentiation should be made therein on the basis of sex.

(b) In all middle schools it is desirable to have mixed staff but where girls do attend schools ordinarily meant for boys, appointment of women teachers on staff should be obligatory.

(3) *Textbooks:*

(a) In textbooks dealing with languages and social studies adequate attention should be paid to the needs, experiences and problems of girls by including such topics as special festivals of women, games popular with girls, lives of great women etc.
(b) One of the important values to be built up through textbooks is to enable each sex to develop a proper respect towards the other.

This Committee took up in early 1962 the study of the problem of “Science Education in Schools”, with the view to find out the relation between the policies and decision of the Centre and the States, and the courses offered in the schools. They also studied the allied problems of:
(i) Growth of school population.
(ii) Shortage of qualified teachers.
(iii) Accelerated achievements in science.
(iv) The demand for increase in technically trained manpower.
(v) Growing importance of science in the affairs of mankind.
(vi) Changes in the processes and goals of science and
(vii) The views held by different thinker in regard to the structure of the school system and the content necessary for education of youth.

2.2.2.10 UNESCO Planning Mission:

In 1963, the USSR Experts of the UNESCO Planning Mission visited India on technical assistance projects. They worked on the problems from 3rd December, 1963 to 10th March, 1964 and gave their recommendations on different issues of science education in secondary schools. Three reports were prepared by the team. These reports gave the total picture of position of science and mathematics education in India and suggested ways to improve it.

As a follow-up programme of the Report of UNESCO Planning Mission of Experts, the department of science education in the national council took up the pilot projects of preparing new curriculum, text books, and teacher’s guides etc. To start with, these experimental projects were started in about 20 selected schools in Delhi.

A conference of science education was convened from 21st to 23rd April, 1966 under the chairmanship of Dr. D. S. Kothari, to plan an effective programme for the development of a total curriculum of science education for different stages. Indian, Russian, American and UNESCO experts in science education participated in the conference.
2.2.2.11 Panel on Science Education in Secondary Schools (1964):

A panel was set up in May 1964 in pursuance of a meeting held by the Planning Commission under the Chairmanship of Prof. M.S. Thacker, Member, Planning Commission. The panel was broad-based and composite representing State Governments, Education Boards, Ministry of Education, Council of Scientific and Industrial Research, National Building Organization, Indian Standards Institute and Independent scientists. The panel examined the procedure for the allotment of funds and procurement of equipment in secondary schools and thereafter drawn standard lists of equipment for science laboratories of secondary schools and suggested grants for the purpose.

The Terms of Reference of the Panel:

(1) Laying down specifications and standards for science equipment and apparatus for high / higher secondary schools.
(2) Standardization of the procedure for the allotment of funds and procurement of scientific equipment.
(3) Preparation of standard lists of scientific equipment and apparatus for high schools.
(4) Preparation of designs and layouts of science laboratories of high schools.
(5) The Panel may also give attention to the following:
   (i) To estimate the requirements of science equipment;
   (ii) To determine the existing domestic supplies with a view to drawing up a project for stepping up domestic manufacture;
   (iii) To draw up a list of apparatus and equipment needed with an idea of its cost and
   (iv) To lay down suitable norms and standards for science apparatus with a view to improve the quality of manufacture.

Recommendations:

(i) When science teaching is to be introduced in a high school; a minimum amount of Rs. 10,000 (including Rs. 1,000 for workshop tools) may be earmarked for setting up a reasonably well-equipped laboratory for physics and chemistry. In case the subject of biology is also introduced, an additional amount of Rs. 3,000 should be provided.
(ii) For middle schools, a sum of Rs. 4,000 (including Rs. 1,000 for workshop tools) for science equipment is considered essential.
(iii) An annual grant of Rs. 10 per student should be sanctioned for replacement and other recurring expenditure for science practical in high schools. In the case of middle schools, Rs. 2 per student per year for the recurring grants and replacement would be adequate.

(iv) Where science fees are charged from the students, the amount so collected should be allowed to be retained by the schools for their science laboratories which should be adjusted against their grants for recurring expenditure.

(v) Annual grants for science laboratories should include adequate provision for buying raw materials and the necessary tools for the workshop.

(vi) The lists of equipment for physics, chemistry and biology laboratories of high schools be prepared on the basis of the syllabi. Necessary modifications may be made to suit requirements of syllabus of the board concerned.

(vii) The lists of equipment required for middle schools, as prepared by the National Council of Educational Research and Training is considered essential.

(viii) The essential items of apparatus, as mentioned in the lists of equipment and apparatus should be supplied immediately when science is introduced in class IX.

(ix) In certain States practical laboratory work does not form a part of high school examination. In view of more emphasis being given to the teaching of science in secondary schools, it is hoped that the Boards of Secondary Education will soon introduce a system of evaluation of students practical laboratory work.

(x) Students should be encouraged to make simple scientific instruments themselves since it will give them a practical bias to learn science at the secondary school stage.

(xi) Each middle and high school should have a workshop attached to it for which a grant of Rs. 1,000 should separately be sanctioned.

(xii) Adequate facilities should be provided to science teachers and students for working on hobbies during schools hours and in their spare time refresher courses for the subjects as well as for workshop training should be arranged for teachers periodically on a regional or district basis.

(xiii) The National Council of Educational Research and Training may be requested to set up, on a high priority basis, a semi-autonomous agency for undertaking the work of laying down norms and standards for science apparatus.
(xiv) In the training programme for secondary school teachers, adequate emphasis should be given to the imparting of training in workshop methods so that teachers and students could make parts of simple science equipment themselves and undertake simple repairs.

(xv) Teachers training institutions should be provided with appropriate workshops to impart necessary skills to the prospective science teachers.

(xvi) For increased production of science equipment, it is recommended that the State Governments may estimate their requirements during the next plan period and thereafter the Planning Commission may take up the question of increased production with the manufactures direct or through the Council of Scientific and Industrial Research.

(xvii) The creation of a separate branch of science education in each State Department of Education under a Special Officer would strengthen considerably the steps that are being taken at various levels for improvement of science teaching. This office should have high qualifications and requisite experience in teaching of a science subject. He may be further assisted by a Science Inspector who may look after the work at district level and ensure proper levels of science teaching.

2.2.2.12 Indian Education Commission (1964-66):

This was the 6th commission in the history of education commissions in India. The unique feature of this commission was not to limit its inquiry to any specific sector or aspect of education as the earlier commissions had done but to have a comprehensive review of the entire educational system. Another feature of the commission is its firm belief that education is the most powerful instrument of national development. The report has been appropriately entitled ‘Education and National Development’.

The progress, welfare and security of the nation depend critically on a rapid, planned and sustained growth in the quality and extent of education and research in science and technology. Science is universal and so can be its benefits. Science represents a cumulative and cooperative activity of mankind and its rate of growth is extremely rapid. The knowledge of science is doubling in a period of ten to fifteen years.

The commission has pointed out that our science education is in bad shape and it becomes worse if we fail to reckon with the explosion of knowledge. To meet this immediate threat, the commission recommended upgrading school curricula by ‘research
in curriculum development, the revision of the textbook and teaching learning material.’ The commission recommended that:

(i) Science and mathematics should be taught on a compulsory basis to all pupils as a part of general education during the first ten years of schooling.

(ii) In the lower primary classes science teaching should be related to the child’s environment. The Roman alphabets should be taught in class IV to facilitate understanding of internationally accepted symbols of scientific measurement and use of maps, charts and statistical tests.

(iii) At the higher primary stage emphasis should be on the acquisition of knowledge and the ability to think logically, to draw conclusions and to make decisions at a higher level. A disciplinary approach to the teaching of science will be more effective than the general science approach.

(iv) A science corner in lower primary schools and a laboratory-cum lecture room in higher primary schools are minimum essential requirements.

(v) At the lower secondary stage, science should be developed as a discipline of the mind. The newer concepts of physics, chemistry and biology and the experimental approach to the learning of science should be stressed.

(vi) Science course as an advanced level may be provided for talented students in selected lower secondary school with necessary facilities of staff and laboratory.

(vii) Science teaching should be linked to agriculture in rural areas and to technology in urban areas.

(viii) The methods of teaching science should be modernized, stressing the investigatory approach and the understanding of the basic principles. Guide materials should be made available to help teachers adopt the approach. Laboratory work will need considerable improvement. There should be flexibility in the curriculum in order to the special needs of the gifted.

(ix) The development of science must derive its nourishment from our cultural and spiritual heritage and not bypass it.

(x) At the university level better conditions for research should be provided.
2.2.2.13 National Policy on Education (1968):

The Education Commission 1964-66 recommended that the Government of India should issue a statement on the National Policy on Education which should provide guidance to the State Governments and the local authorities in preparing and implementing educational plans. In 1967 the Government of India constituted a committee of Members of Parliament on Education to prepare a draft of a statement on the National Policy for Education. The committee brought together, for the first time in recent history, leading members of almost all the political parties in the country and prepared a draft which was considered by the Central Advisory Board of Education. Thereafter the Government of India issued the Resolution on National Policy on Education in 1968.

Science Education and Research:

With a view to accelerating the growth of the national economy, science education and research should receive high priority. Science and mathematics should be an integral part of general education, till the end of the school stage.

The National Policy of 1968 marked a significant step in the history of education in post – independence India. “It aimed to promote national progress, a sense of common citizenship and culture, and to strengthen national integration. It laid stress on the need for a radical reconstruction of the education system, to improve its quality at every stage and gave much greater attention to science and technology, the cultivation of moral values and a closer relation between education and the life of the people,

Since the adoption of the 1968 policy, there has been considerable expansion in educational facilities all over the country at all levels. More than 90% of the country’s rural habitations now have schooling facilities within a radius of one kilometer.

One of the most significant developments has been the acceptance of a common structure of education throughout the country and the introduction of the 10+2+3 system by most states. In the school curricula, in addition to laying down a common scheme of studies for boys and girls, science and mathematics were incorporated as compulsory subjects.
2.2.2.14 Committee on Rural Higher Education (1967-69):

The National Council for Rural Higher Education set up this committee in November 1967 to review the progress of the scheme of Rural Higher Education and to suggest ways and means for improving its working so that the objectives for which it was started may be achieved.

*Extension of Science Education and Research:*

The extension work should mainly relate to the application of scientific knowledge and techniques to the rural problems. The activities may also include clubs, adult schools, women programmes, etc with a view to educating the rural community to adopt latest techniques and scientific ideas in the field. The teaching in the rural institutes should be closely related to research and extension facilitating an integrated approach to rural problems.

2.2.2.15 Ishwarbhai Patel Committee (1977):

As a follow-up of the Kothari Commission Report, the Ministry of Education and Social Welfare appointed an expert group in 1973 to develop curriculum for the 10+2 pattern. The group drafted an approach paper in 1975. A publication entitled “The Curriculum for the Ten-Year School – A Framework” was published by the NCERT which also prepared syllabi, textbooks and the materials in a phase manner. Materials for classes IX and X were prepared in a few subjects for 1975-76 sessions and for classes I, III and VI for 1976-77 session. The Central Board of Secondary Education adopted some of the textbooks prepared by NCERT for classes IX and X and the first badge of candidates appeared in the public examination for class X held in April 1977.

The syllabi and the textbooks prepared by NCERT, especially for classes IX and X, evoked a lot of criticism from parents, teachers and students. The main criticism was that the scheme of examination contained many subjects of students, the textbooks were too many and too voluminous and therefore, there was no time for self-study and physical activities. Another area of criticism was that work experience did not find a proper place in the teaching-learning process in the new pattern of education, thus maintaining the same system of bookish education.
As a result of the criticism of the new syllabi and textbooks, the Union Minister of Education and Social Welfare appointed a Review Committee in June, 1977 under the chairmanship of Sri Iswarbhai J.Patel, Vice-Chancellor, Gujarat University with 30 members on the committee from various organizations. The committee submitted its report in November 1977 under the title “Report of the Review Committee on the Curriculum for the Ten Year School”.

The following were the terms of reference of the committee:

(i) To review the stage wise and subject wise objectives identified in the NCERT document “The curriculum for the 10-Year School”.
(ii) To scrutinize the NCERT syllabus and textbooks, in the light of the review as per (1) above.
(iii) To scrutinize the scheme of studies, as given in the said document and examine whether any suitable modifications in either the scheme of studies or the timetable or both should not be made and to propose suitable staffing pattern.
(iv) To review the present scheme of studies and the time allocated for various subjects with a view to ensure that:
   (a) The institution / teacher have adequate time for experimentation, creative work, remedial instruction etc.
   (b) To accommodate the needs of the bright child for advanced level course; the specific interests and aptitude, or the lack of it, in children, in only certain subject areas, keeping in view the national goals of development and objectives of education.

In the opinion of the committee the terms of reference were wide enough not only to permit a review of the objectives and scheme of studies set out in the document 3 “The Curriculum of the Ten-Year School” but also to identify the principles for formulating a new scheme.

2.2.2.16 National Policy on Education (1986):

In January 1985, the Government of India announced that a new education policy would be formulated for the country. A comprehensive appraisal of the existing educational scene was made followed by a countrywide debate. The views and suggestions received from different quarters were carefully studied. As a result a new National Policy on Education was formulated in 1986.
According to this Policy the National System of Education is to be based on a national curricular framework which contains a common core along with other components. The common core includes the history of India’s freedom movement, the constitutional obligations and other content essential to nurture national identity. These elements cut across subject areas and are designed to promote values such as India’s common cultural heritage, egalitarianism, democracy and secularism, equality of the sexes, protection of the environment, removal of social barriers, observance of the small family norm and inculcation of the scientific temper.

The NPE has reiterated the importance of mathematics and science education as well as inculcation of scientific temper. The committee set up under the chairmanship of Prof. Yash Pal, former Chairman; UGC for implementation of programmes for the improvement of the science education has stressed the need for proper motivation of teachers in order to enable them to play their role effectively and provision of suitable training to them. To implement this programme, a detailed scheme for the improvement of science education in schools was prepared. The scheme was approved for implementation in 1987-88. The salient features of the scheme were:

(i) Provision of science kits to 90,000 upper primary schools.
(ii) Assistance to 22,500 secondary and higher secondary schools having laboratory room and science teachers, to acquire science equipment.
(iii) A one-time assistance of Rs 15,000/- per secondary and higher secondary school for 40,000 secondary and higher secondary schools each to procure about 500 books relating to science and mathematics.
(iv) Identification of an education institution or voluntary agency in each district to act as resource centre to help science teachers. Each resource center is to be given equipment worth Rs. 1 lakh.
(v) Conducting in-service training in the form of summer institutes in institutions of higher education courses in secondary Teacher Training Colleges.
(vi) Assistance on 100% basis to voluntary organizations having expertise to promote scientific temper and science education.
(vii) As a follow up of recommendation of this committee NCERT has designed a functional science kit for upper primary level costing Rs. 1200/- has prepared list of
recommended books and the standard list of equipment with specification for science laboratories in secondary and higher secondary schools.

2.2.2.17 Learning without Burden: Reports (1993):

From time to time a great concern regarding academic burden on students and unsatisfactory quality of learning has been voiced in our country. With a view to have a fresh look on this problem, the Ministry of Human Resources Development, Government of India appointed a National Advisory Committee in March 1992. The Committee was headed by Prof. Yash Pal, former Chairman University Grants Commission and included 7 other members. The committee gave its recommendations in July 1993.

In recommendation No. 12(d), committee recommends that science syllabi and textbooks in the primary classes should provide greater room and necessity for experimentation than they do at present. In place of didacticism in areas like health and sanitation, the texts should emphasize analytical reflection on real-life situations. A great deal of trivial material included in primary-level science texts should be dropped.

In recommendation No. 12(e), committee recommends that the syllabi of natural sciences throughout the secondary and senior secondary classes be revised in a manner so as to ensure that most of the topics included are actively linked to experiments or activities that can be performed by children and teachers.

2.2.2.18 Different plans on Science Education:

3rd Plan 1960-61 to 1965-66

In the third plan, in addition to providing general science in all the secondary schools as a compulsory subject, more than 9,500 out of 21,800 secondary schools were also to have science of an elective standard. A number of supporting measures were also proposed to be taken to improve and strengthen the teaching of Science. A scheme of science talent search is to be introduced with a view to identifying promising talent at the secondary stage and providing opportunities for its development.

6th Plan 1980-85

Science teaching should be strengthened and laboratory equipment provided, both for experimentation and demonstration. The curriculum in science and mathematics
would continue to be reviewed and upgraded and pre-service as well as in-service training of teachers in all subjects promoted on an extensive scale. The educational system would also recognize the needs of the exceptionally talented children in the special courses or programmes of studies.

7th Plan 1985-86 to 1989-90

The teaching of science and mathematics at high/higher secondary stage of education will be strengthened and made universal.

9th Plan 1997-2002

Special measures will be taken to promote teaching of mathematics and science at the secondary stage by devising new popular source books. A Science Talent Research Scheme will be promoted. Science and mathematics will be linked to the immediate environment of the child. Efforts will be made to avoid the unnecessary load of a crowded curriculum.

10th Plan 2002-2007

Quality improvement in schools comprises the centrally sponsored schemes of promotion of science laboratories, environmental orientation to school education, promotion of yoga, as well as the central sector schemes of Population Education Project, international mathematics/science Olympiad. The State governments would develop training modules for in-service training of teachers and provide infrastructure and research inputs for quality improvement in schools. The key theme in the 10th Plan is imparting quality education at all stages of education and the pursuit of excellence. The on-going efforts in revision of curricula at the secondary education level, so as to make it more relevant, would continue in the 10th Plan. The convergence of centrally-sponsored schemes will help in imparting science, mathematics and computer education as well as environmental and value education in a more focused manner.

2.2.2.19 Science Education in Broader Perspective:

In general it is nothing but the teaching-learning process of science at all levels in schools, colleges and universities. In early sixties, simultaneously with the formation of
NCERT, a proposal was initiated to treat ‘Science Education’ as a subject to deal with different issues of science teaching like curriculum development, teaching methods, creativity in teaching, evaluation etc. The main objective to promote science education as a subject was to train up school teachers from primary to higher secondary stage so that they can teach science efficiently to the school students. At present, scope for application of ‘science education concept’ on college and university teachers is also possible through orientation and refresher courses. With the changing scenario in the global educational arena, science education is gradually becoming indispensable for Engineering and Technology Education also because thorough knowledge of science, consolidate the base of engineering and technology students.

If anybody look into the history of science education in independent India it will be seen that a number of commissions and national / international agencies made several recommendations which were implemented partly or fully for improvement of science teaching-learning system. Some of such recommendations and the proposing bodies are:

(i) Teaching of science from primary level (school) to undergraduate level (College) by the University Grants Commission.

(ii) Teaching of general science from middle school to high school by the Secondary Education Commission.

(iii) Teaching biology, physics and chemistry as integral subjects in classes VII and VIII by USNESCO Planning Mission.

(iv) Teaching physics, chemistry and biology in class VI and physics, biology, chemistry and astronomy in class VII by Education Commission of 1964-66.

(v) Teaching science as environmental studies in primary classes and as integrated course up to class VIII by Ten Year School Curriculum expert group.

(vi) Teaching science and environment related issues in an integrated way by NCERT and State Institutes of Education (SIE).

(vii) Yager (1984) as a proponent of STS (Science, Technology and Society) movement suggested that application of science and technology knowledge is a necessity for social improvement. School curriculum should be framed accordingly.

(viii) Report of the committee headed by Yashpal (1993) suggested that science text books should have analytical reflection of real life situation.
Of the above recommendations at least the last three i.e. 6, 7 and 8 are influenced by the global bodies like “American Association for the Advancement of Science (AAAS – 1985)”, “Project 2001, Science for All Americans”, “Hands on Science (HOS) Programme”, “Nuffield Programmes’ etc. Attempts were also made to improve science education by introducing Hoshangabad Science Curriculum, Eklavya Science Activities and Kishore Bharati Teaching Learning Material at the elementary level.

In addition to implementation of the above recommendations, 4State Institute of Science Education (SISE) was established to find out additional ways and means for improvement of science teaching-learning system. Such institutes were directed to look after the implementation of educational policies and also to take steps for development of National Science Curriculum based on glimpses of international thoughts and ideas suitable for our local target groups. Coordination amongst curriculum developers and teachers was also urged upon. SISE experts were further instructed to frame curricula having inter-disciplinary approach and social relevance and also satisfying needs and interest of the students who are ultimate beneficiaries of the education system. School authorities were directed to uplift their infrastructure towards manpower and laboratory facilities to facilitate improved science teaching as a pre-requisite to College and University level teaching as well as research.

2.2.2.20 Science Education in India:

Schooling of a child in India usually starts at the age of 5-6 years. All States follow a uniform academic system i.e. the 10+2 system or higher secondary. The curricula are either developed by the respective state boards/councils or by the national boards like the Central Board of Secondary Education (CBSE) or by Council for the Indian School Certificate Examinations (CISCE). All curricula are not same; however the basic knowledge of science including physics, chemistry and biology and mathematics is compulsory for every student till 10th grade.

After class 10th, a student gets the freedom to choose any of the three streams – science, commerce or arts. In 11th and 12th class, students learn the introductory courses of physics, chemistry, biology and/or mathematics. One can choose different combination
of subjects from physics, chemistry, biology, mathematics, geology, statistics, computer science etc. After completion of +2 Sc one can either continue in the conventional system of education i.e. by doing B.Sc, M.Sc etc or can opt for a professional career. This is about the education hierarchy in India.

Looking at the quality and scope of science education in India the non uniformity in the system is quite visible. This may be due to various causes. One major cause is the socio economic difference between rural and urban India. However, the State as well the union governments are in a constant endeavor to fill this gap up and to provide every citizen of the country quality as well as affordable education.

Creating enthusiasm among students to learn science is the most widespread activity in India being carried out at present. The government is popularizing the discipline by means of popular science articles, organizing lectures, through various scholarship schemes and through the establishment of science centers etc. Efforts in this direction have come from both individuals and from institutions. There are several organizations and institutions both public and private trying to change the scene of science education in India.

2.2.2.21 Development in Science:

In the beginning of the modern period the position of India in science and technology was not at all satisfactory. But with the beginning of the twentieth century considerable changes began to take place in this field. Jagadish Chandra Bose, Sreenivasa Ramanujan and many others led India to the path of modern science. After independence Indian scientists worked with devotion to attain scientific progress. The Scientific and Industrial Research Council founded in 1942 gained more prominence after independence. Dr. Vikram Sarabhai is regarded as the father of Indian Space Research Programme. Hom. J. Bhabha gave leadership to research in atomic energy. Dr. A.P.J.Abdul Kalam, our Ex-President, is regarded as the father of Indian missile technology.

The first rocket in India was launched from Thumba Rocket Launching Station, Thiruvananthapuram, on 21st November 1963. It was led by National Space Research
Organization (NSRO). Dr. Vikram Sarabhai was its head. The researches at Thumba paved the way for the launching of artificial satellites including INSAT.

The resolution relating to the science policy of 1958 characterized science as the “Key to National Development”. India’s achievements in space research and missile technology are comparable to those of the developed nations. With the founding of Indian Space Research Organization (ISRO) on 15th August, 1969, India geared up for a big leap. India established its nuclear potential with the atomic explosion at Pokhran in Rajasthan in 1974. “Buddha Smiles” was the code name given to it. With another atomic explosion at Pokhran in 1998 India declared herself an atomic nation. India’s achievements in the field of rocket launching have reached the level of the development of cryogenic engine. Rockets with cryogenic engines were necessary to amplify the thrust force so that the comparatively heavier communication satellites could be carried to the orbit. India is the sixth country in the world that possesses such satellite launching vehicles. In missile technology India made achievements comparable to those of the developed countries. India had developed missiles for depending itself against the frequent foreign invasions what it had to face since independence. From missiles with short ranges to the ones with a long reach of 3000 kms, India possesses missiles of all ranges. Almost all the facilities acquired by developed countries are available in India also. In India there is facility to manufacture super computers, to give birth to test tube babies and to do complicated surgeries. We could manufacture new medicines through researches without depending on foreign countries.

2.2.2.22 Satellite-Based Education:

The first published idea on satellite broadcast came from an American writer of Science, Fact and Fiction, Prof. Arthur C. Clarke in his article “Wireless World” in 1945. Clarke foresaw, that it would be possible to provide complete radio coverage of the world from just 3 satellite, provided they are precisely placed in a particular path known as ‘Geo-stationary Orbit’.

The first artificial satellite into the orbit was put by the Russians on 4th October, 1957 and from that time onwards techniques to put machinery and men into space have rapidly advanced. The first communication satellite capability of relaying messages
immediately was launched in 1962, called Tilstar, which circulated the earth at a height between 960 kms and 5600 kms orbit known also as highly electrical. The first commercial satellite known as Intelsat – I, called Early Bird, was launched on 6th April, 1965. It weighed less than 40 kg in orbit and offered 240 television circuits or 1 TV channel. This marked in Intelsat Early Bird as the world’s first commercial communication satellite for television, voice and facsimile.

In India, the first satellite communication was conducted in the year 1975-76 with ATS-6 loaned by USA to the Government of India for one year to use satellite in transmitting TV programmes to remote villages in the region. With the launch of INSAT satellite in the early 80s, India started using satellite communication for its own developmental purposes as well as for education from its indigenous based satellite system, known as INSAT. Today, India has reached almost all corners of the country as well as other parts of the world, wherever INSAT satellite signals are being received. Today, India has several INSAT satellites in the orbit and currently INSAT 4-A has been put into orbit and other satellites are also in the pipeline.

The Satellite Instructional Television Experiment (SITE) gave vision of using satellite for social transformation that hired many experts from the field of engineering, science, communication, managers as well as social scientists. Educational institutions of the country have continuously endeavoured to use the latest technologies to support the process of education. For this purpose, we need a system which can sustain the increasing demand. The challenge of the present world is to stay updated with the changing world every moment. It was the vision of Prof. Satish Dhawan, former Chairman, ISRO, who started discussion on development of satellite exclusively for educational purposes. To support his challenges and vision, ISRO launched EDUSAT, a satellite exclusively dedicated to education, on September 20, 2004 with the major objectives to provide support to both formal and non-formal education systems in India through low-cost ground system.

EDUSAT, a dedicated satellite for education, was launched by the Indian Space Research Organization (ISRO) in September 20, 2004. It provides an extended ‘C’ band national beam, a KU band national beam and 5 KU band regional beams. The regional beams will facilitate in imparting education in the regional languages. EDUSAT provides
communication capacities to meet the requirements of different sectors of education. Be it primary, secondary, tertiary / higher, professional or be it class or distance learning. The EDUSAT network is used for live transmission of classroom programmes received by all institutions having Satellite Interactive Terminals (SIT) or Receive Only Terminals (ROTs). Students attending a session can also interact with experts through audio-video conferencing, text mode and telephone. In this satellite-based education teaching of expert, resource personnel shall reach to far-flung remote areas from a centre. It shall not only play a vital role in overcoming the problem of getting good teachers but will play a vital role in reducing the rate of dropout.

EDUSAT was first introduced in March 2005 with the launching of a primary education project in Karnataka’s Chamarajanagar District. Ground infrastructure for utilization of EDUSAT has been largely created by ISRO, which invested Rs. 89.00 crore in the programme till December 2006. The University Grants Commission (UGC), through its body Consortium for Educational Communication (CEC) is utilizing EDUSAT facility for curriculum based education. All India Council for Technical Education (AICTE) is sponsoring telecasting of programmes through AICTE-EDUSAT network mostly for curriculum based teaching as also for conducting training programmes and seminars. The infrastructure of EDUSAT is being also utilized by Indira Gandhi National Open University (IGNOU) for curriculum based education, teachers’ training, professional educational course and for conducting teleconferencing sessions for software content generation. The National Council of Educational Research and Training (NCERT) is conducting inter-active orientation and training programmes of teachers and teachers’ educators. Department of Science and Technology (DST) is utilizing EDUSAT network for group discussion, lectures, demonstrations, video-shows, training and capacity building programmes.

EDUSAT gives flexibility to the teacher trainees and others to use the information, communication and technology in a much effective and lucid way to impart knowledge skills as well as make the teaching and learning more interesting with the technology – enabled learning. Although presently EDUSAT has its own limitation, surely with the improvement in the system, EDUSAT can be used very well for asynchronous and synchronous learning anytime anywhere with the help of web cast.
This can also be used for solving the problem of clarifying doubts by students from various parts of the country directly with the best teachers through the live mode.

2.2.2.23 The 1968 Education Policy and after:

The National Policy of 1968 marked a significant step in the history of education in post-Independence India. It aimed to promote national progress, a sense of common citizenship and culture, and to strengthen national integration. It laid stress on the need for a radical reconstruction of the education system, to improve its quality at all stages, and gave much greater attention to science and technology, to cultivation of moral values and a closer relation between education and the life of the people.

Perhaps the most notable development has been the acceptance of a common structure of education throughout the country and the introduction of the 10+2+3 system by most States. In the school curricula, in addition to laying down a common scheme of studies for boys and girls, science and mathematics were incorporated as compulsory subjects and work experience assigned a place of importance.

**National system of Education:** In the areas of research and development, and education in science and technology, special measures will be taken to establish network arrangements between different institutions in the country to pool their resources and participate in projects of national importance.

The Nation as a whole will assume the responsibility of providing resource support for implementing programmes of educational transformation, reducing disparities, universalisation of elementary education, adult literacy, scientific and technological research etc.

**School facilities:** Provision will be made of essential facilities in primary schools, including at least two reasonably large rooms that are usable in all weather, and the necessary toys, blackboards, maps, charts and other learning material. At least two teachers, one of whom is a woman, should work in every school, the number increasing as early as possible to one teacher per class. A phased drive, symbolically called Operation Blackboard, will be undertaken with immediate effect to improve primary schools all over the country. Government, local bodies, voluntary agencies and individuals will be fully involved.
**Secondary Education**: Secondary education begins to expose students to the differentiated roles of science, the humanities and social sciences. This is also an appropriate stage to provide children with a sense of history and national perspective and give them opportunities to understand their constitutional duties and rights as citizens. Conscious internalization of a healthy work ethos and of the values of a humane and composite culture will be brought about through appropriately formulated curricula. Vocationalisation through specialized institutions or through the refashioning of secondary education can, at this stage, provide valuable manpower for economic growth. Access to secondary education will be widened to cover areas unserved by it at present. In other areas, the main emphasis will be on consolidation.

**Science Education**: Science education will be strengthened so as to develop in the child well defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question and an aesthetic sensitivity.

Science education programmes will be designed to enable the learner to acquire problem solving and decision making skills and to discover the relationship of science with health, agriculture, industry and other aspects of daily life. Every effort will be made to extend science education to the vast numbers who have remained outside the pale of formal education.

**Science Education and Research**: With a view to accelerating the growth of the national economy, science education, and research should receive high priority. Science and mathematics should be an integral part of general education till the end of the school stage.

### 2.2.2.24 Science Education Programme at the Elementary Stage:

Started in 1969-70 on a pilot basis, Science Education Programme at the Elementary Stage has been continued on a wider phase during the Fifth Plan period, with assistance from UNICEF. The achievements so far recorded are as follows:

(i) With 8,999 primary science kits supplied during 1978-79 the total number of primary schools provided with science kits comes to 47,571.

(ii) With 13,500 primary teachers trained during 1978-79 the total number of teachers trained so far is 61,697. Besides, 22,053 of other personnel like inspectors, methods masters, head-masters etc. have been trained.
(iii) 149 teacher training schools have been selected during the year for strengthening with the supply of science equipment and books, bringing the total number to 822.

(iv) 1,800 metric tones of paper have been supplied during the year for printing of textbooks, teacher guides, etc.

(v) Under pilot programme on Nutrition, Health Education and Environmental Sanitation, five regional centers at Baroda, Kolkata, Coimbatore, Jabalpur and Ludhiana have developed curricular materials in English and regional languages for introduction as an integral part of Science Education Programme, besides undertaking programmes for training of teachers in the concerned regions.

(vi) Through a series of workshops a band-book for primary science teachers has been developed in regard to environmental science and improvisation of local resources.

2.2.2.25 Integrated Science Curriculum at National Level:

The approach paper “Curriculum for 10 year School --- A Framework” developed by the NCERT in 1975 recommended the introduction of integrated science curriculum at the middle stage of elementary education. While developing the syllabuses, textbooks, teachers’ guides, test items, kits, kit guides and some audio-visual aids, the NCERT developed a document to discuss the philosophical, pedagogical and operational factors in favour of the integrated science curriculum (NCERT 1979). The nature of scientific knowledge, the process of science, basic concepts or themes which cut across various disciplines and presence of a common value base of all disciplines of science which speak about the unity in the nature of science constituted the integrated science course. This idea of teaching science as a unity continued and in spite of facing several constraints was accepted at the upper primary stage. After 1986, this approach was extended to the secondary level i.e. classes IX and X.

2.2.2.26 Science Education Programme:

Central Government of India has started science education programme through Universal, Free and Compulsory Elementary Education under the department of School Education. Implemented since 1970-71 on a pilot basis, science education programme was continued on a wider basis during the Fifth Plan period. A significant component of the science education programme has been a project of Nutrition and Health Education.
and Environmental Sanitation in Primary Schools, implemented, on an experimental basis, through 5 Regional Nutrition Education Centers. Under this project, handbooks for primary teachers to teach environmental science with the help of local resources and improvisation were developed.

The National Council of Educational Research and Training (NCERT) was established in 1961 to assist and advise the Ministry of Education and Culture in implementing policies and major programmes in the field of education, particularly school education. The NCERT continued to undertake research, training, development and extension activities for qualitative improvement of school education in the country. Activities were determined by the emerging social concern of the national task of over-all economic development and the main focus of attention was in the direction of preparation of textbooks, etc., for the 10+2 pattern of schooling, universalisation of elementary education, vocationalisation of education and improvement of teacher training. The important development activities with special reference to science education include preparation and production of 12,000 primary science kits for the States, proto-types of an integrated science kit for the middle stage, an electronic kit for the secondary stage, low-cost teaching aids for rural primary teachers and audio-visual materials for non-formal education of rural adults.

2.2.2.27 Methodology of Development:

In depth study of the instructional materials developed in earlier generation i.e. before 1975 and contemporary thoughts developed in the area of science education provided the necessary guideline to the department of education in science and mathematics of NCERT to develop the structure, content and process of upper primary and secondary science education. It agreed with the views of Booth (1978) and Showalter (1978) and felt that demands of higher education and employer should not shape the courses of general education. At the same time cautions raised by Rutherford and Gardner (1973) and Rutherford (1978) were kept in mind. It was agreed that science in general education should be
(i) For the enquiring mind,
(ii) For action and
(iii) For citizenship.
The trend should continue up to the secondary level. But due to the limitation of resources, the introduction of the integrated science curricula in the 1st phase (1975-79) was restricted up to the upper primary level (classes VI to VIII i.e. age from 11-13). In order to avoid complete diversion from the existing discipline-wise curriculum the topics selected resembled bits of physics, chemistry and biology. In the course these were presented as child’s area of experience in the environment. For example, light, separation of substances and plant life, are not the monopolies of Physicists, Chemists or Biologists. These are areas of experience to all (Ganguly 1987). Thus presenting coordinated or primary level of integration (Blum, 1973), the integration matrix include elements from three disciplines of sciences, child’s environment and important societal issues.

**Objectives of Science for the Upper Primary Stage:**

(i) To emphasize the relevance of science to daily life,

(ii) To develop scientific attitudes,

(iii) To create an environment conducive to greater reliance on the use of principles and practices of science,

(iv) To acquaint the pupils with various natural phenomena,

(v) To emphasize the experimental nature of science and

(vi) To emphasize the unity of methods of different disciplines of science.

**Objectives of Science for the Secondary Stage:**

(i) Consolidate and strengthen the knowledge competencies and skills acquired up to the upper primary stage,

(ii) Acquire understanding of scientific concepts, principles and laws,

(iii) Develop instrumental, communicational and problem-solving skills,

(iv) Develop scientific temper, scientific approach and scientific attitude such as open mindedness, intellectual honesty, course to ask questions, respect for human dignity and decision-making,

(v) Cultivate social, ethical, moral and aesthetic values which exalt and refine the life of an individual and also the society and

(vi) Appreciate the contributions of scientists and develop sensitivity to possible uses of science and concern for clean and healthy environment and preservation of ecosystem and to create an awareness to guard against the possible misuse of science.
The National Policy of Education (1986) confirmed the earlier decision to strengthen science in general education. At the same time, it was also reminded that education must work towards the protection of the environment. A committee on science education in 1986 (known as Prof. Yash Pal committee) recommended that approach by NCERT for the upper primary level should constitute science in the first 10 years of general education. The working group also identified seven dimensions of science education (NCERT, 1987) to be attained through this course. Syllabus and instructional packages were developed along this guideline by a team of scientists, teacher educators, classroom teachers and representatives of voluntary agencies. At this stage it was decided to drop the word “Integrated” from the courses of upper primary and secondary level and to call as science only.

Indian National Science Academy (INSA) is continuing its efforts in the area of science capacity building through its interaction with NCERT, UGC and other national bodies for the promotion of science education. Many activities such as publication of popular books/monographs in different science disciplines, multimedia preparation, providing interlinks between institutions, creation of website of different organizations in the country describing their activities and experiences in science education and others. INSA strongly believes in the creation of an enabling environment for extensive and intimate interaction among scientists, students, educators and government administrators towards capacity building in science.

2.2.2.28 Development of Science Education in different States & Union Territories:

**Andaman and Nicobar Islands:** General science is taught as a compulsory subject up to the secondary stage and as an elective subject from class IX in all the higher secondary schools. Steps are being taken to provide equipment for the science laboratories. For better teaching of general science, qualified science teachers have been provided to three senior Basic schools and all the higher secondary schools.

**Chandigarh:** Science is taught as a compulsory subject up to the middle department and as an elective subject in higher secondary classes. Science laboratories in secondary schools have been adequately equipped.
Delhi: In order to make the teaching of science more effective steps have been taken to strengthen school laboratories with equipment.

Goa, Daman and Diu: General science is a compulsory subject from standard V onwards. Special grants for the purchase of laboratory equipment for physics and chemistry sections are being paid by the Government. Steps are being taken to provide science equipment to elementary schools also.

Himachal Pradesh: Teaching of general science is provided in all primary, middle, high and higher secondary schools. Steps taken to improve the teaching of science in schools included the following: (i) Two science consultants for elementary schools and five science consultants for secondary schools have been appointed; (ii) Science clubs were started in a number of schools; (iii) Seminars/workshops on teaching and evaluation in science were organized at various levels; and (iv) Content course of two months’ duration for teachers of general science in middle classes were conducted.

Manipur: General science is taught as a compulsory subject up to class VIII in high schools and up to class X in higher secondary schools. It is taught as an elective subject from class XI onwards.

Pondicherry: Study of science at primary, upper primary and secondary stages is compulsory. Steps are being taken to strengthen laboratories in middle and high schools with science equipment.

Tripura: Up to class X, general science is taught as a compulsory subject and at the higher secondary stage it is taught as an elective subject. In order to improve the standard of science teaching, it is proposed to introduce new methods of science teaching in school and establish science units under the Education Directorate. Provision has also been made to provide science equipment to laboratories in middle and higher secondary schools. Intelligent science students are given special prizes in the higher secondary schools.

2.2.2.29 National Council for Science & Technology Communication (NCSTC):

The NCSTC, ever since its inception in 1982, has been engaged in science and technology communication / popularization and inculcation of scientific temper among the people. The emphasis has been on development, adaptation, promotion and use of different communication methodologies. Various media, traditional and non-traditional,
being utilized for the purpose, include print, audio/radio, video/TV and folk-forms like songs, dances, street-plays, puppetry etc. major programmes undertaken during the year 2000-2001 are described below.

**National Children’s Science Congress (NCSC) – 2000:** This is a programme involving children in the age group of 10-17 years, from all over the country, to encourage them to
(i) Know their immediate social and physical environment and
(ii) Provide them a forum to interact with scientists to quench their thirst for curiosity and creativity. During the course of NCSC, children take up scientific projects related to local issues, work under the guidance of the teachers/science activities, and report their findings at school block or district level congresses. Selected projects are presented at state and national levels respectively. Children are given freedom to present and write their project reports using their mother tongue.

**Science & Technology for the Visually Challenged:** NCSTC has embarked upon a new programme “Science and Technology for the Visually Challenged” that may involve development of software like specially designed science kits/books in Braille on selected topics in Science & Technology with tactile diagrams, talking books (audio cassettes), a science magazine in Braille/audio cassette (talking magazine) and so on.

**Emergence of Modern Science:** A new initiative in the form of a countrywide campaign jointly with Vigyan Prasar titled “Emergence of Modern Science” has been taken up marking the centenary of the golden decade 1895-1905 during which fundamental scientific discoveries and important technological developments took place. The campaign involves students/teachers/general community and is being organized in collaboration with State Science & Technology Councils / Departments and voluntary organizations. Five Regional Master Resource Persons’ training programmes were organized at Patna (August 07-08, 2000), Bangalore (August 11-12, 2000), Shillong (August 18-19, 2000 and November 02-03, 2000), and Gandhi Nagar (August 28-29, 2000). Seven articles were brought out as resource material and distributed to the participants in the Master Resource Persons’ training programmes. These articles would also be translated in local languages by the respective State Science & Technology Councils/ Departments. The salient features of the programme included lecturer/demonstrations about the discoveries made during the decade 1895-1905
highlighting the scientific method and the lives of the scientists who made these discoveries. The topics discussed included X-rays, radioactivity, the discovery of the electron, quantum theory, explanation of the photoelectric effect, relativity, beginnings of biochemistry, location of malaria parasites in the female anopheles mosquito, radio communication and the discovery of the ionosphere and the technological advances like the first successful airplane, vacuum tubes, first electric locomotive, first practical photoelectric cell etc. The programmes in the States for resource persons, school/college students and the general public commenced during October/November, 2000.

Field Programmes:
(i) To attract, encourage and create interest among bright students to select research and teaching as careers in science & technology, a programme has been formulated. Selected science students of class XI closely interact with an eminent scientist in a national laboratory or in the science department of a leading university. This opportunity of about 7 days is limited to a batch of 20-25 students drawn from the localities and adjacent districts. So far about 30 programmes have been organized at RRL, Jorhat (5); BSIP Lucknow (2); Anna University, Chennai (4); Karnataka University, Dharwad (4); Bhopal (2); ARC, Hyderabad; Viswa Bharati, Shantiniketan; G.B. Pant Institute of Himalayan Environment and Development, Almora; BHU, Varanasi; Punjab University; Chandigarh; Meerut University; Kumaun University, Nainital; P.G. College, Pithodagadh; Ooty and Cochin. Proposals are under consideration from Tezpur, Jodhpur and a few other places.

(ii) Science & Technology plays a major role in the development and progress of a nation. They help to grow and develop important sectors, namely agriculture, housing, environment, defence, health, transport, industry, communication and others. Understanding how these sectors are utilizing science & technology as a tool for development can be an important activity for students. Looking into the importance of this, NCSTC has formulated a programme to expose young students to the exciting world of science & technology; trigger an interest in science & technology subjects and develop curiosity, creativity and urge for innovations in the field of science & technology. This programme can be organized by the NGOs, Science clubs and even an individual or a group of schools with a team of 35-40 students for 5-6 days. This programme has so far
been organized for the students of Lucknow, Ghaziabad, Suri (W.B), West Godavari (A.P), Gobardanga (W.B), Mathura (U.P) and Chennai. Proposals are under consideration from a few other places.

(iii) A lecture/demonstration programme is being formulated to help pre-college level students experience the excitement of science. The programme is expected to encourage them to pursue higher studies and careers in basic sciences. Identification and development of communicators / speakers, who can excite interest in science is the most important aspect of this programme.

(iv) A unique 7 day children’s activity camp was organized by Yuva Parishad, Gwalior (MP) during June 20-26, 2000 at Gwalior. The main objective of this programme was to expose children to a wide variety of science popularization activities and recent science & technology developments in different disciplines, alongwith a face to face interaction with scientists. About 100 children participated in different programmes like illusion and reality, science plays, nature camp, origami, drawing and painting competition, quizzes and science in folk games etc.

(v) A project for development of a module for science clubs has been supported to science centre, Gwalior.

**Training Programmes:**

(i) A workshop on “Scientifically Explaining Miracles shown by Godmen” was organized by the Science Centre, Gwalior, at Piplode, Distt. Ratlam, M.P. during March 27-31, 2000 in which 25 activities including high school science teachers participated. A workshop was organized by the action for social change, Vaishali, Bihar during April 08-12, 2000. Around 35 teachers/voluntary activities participated in the 5 day workshop. Similar workshops were organized by Mona Kalyan Samiti, Shahajahanpur at Patna during October 16-20, 2000 and by the society for social development, Gwalior in November, 2000 at Gwalior. A national level workshop was organized at the Gram Niyojan Kendra, Ghaziabad, UP, during September 14-15, 2000 in which 30 master resource persons from different parts of the country participated. Public performances on scientifically explaining miracles were organized in Haryana, Punjab and Rajasthan by various agencies.
(ii) Training Camps/Workshops was organized to popularize science & technology among the rural population of Maharashtra by the Andh Shardha Nirmulan Samiti, Maharashtra. This programme was conducted through programmes like Vigyan Parichay & Vigyan Shodh. Primary and secondary school students from 25 districts of Maharashtra were participated in this programme. Training camps/ workshops was organized for teachers from all over Maharashtra. It was a two year programme that commenced in April 2000.

(iii) A training workshop on “Model Rocketry” was organized in Dharwad (Karnataka), by the Institute of Education, Science & Technology for people, Dharwad, during June 5-6, 2000. About fifty science teachers participated in the programme. Similar workshops were organized by the Centre for Science Education, NEHU, Shillong, at Jorethang (Sikkim) during March 21-25, 2000 and Agartala, Tripura during March 28, April 1, 20000, respectively. A model rocketry training workshop was organized by Pathani Samantha Planetarium, Bhubaneswar, during October 8-12, 2000. More training workshops on “Model Rocketry” are in the pipeline at Chandigarh, Bhubaneswar, Bhopal and Imphal. The participants get an exposure to various principles of physics like laws of motion, thrust, drag, force, etc. and also make working models of rockets.

(iv) A 3 day training programme on understanding characteristics of LASER was organized in collaboration with Department of Science & Technology, Government of Rajasthan. The main idea for organizing this training workshop was to educate senior school science teachers about optics and different applications of LASERs. Similar workshops were organized by 1) Science & Society, Patna ;2) Institute for Integrated Society Development (UP); 3) State Council for Science & Technology (Rajasthan) at Jaipur; 4) State Council for Science & Technology (Bihar), Patna; 5) State Council for Science & Technology (UP), Lucknow and 6) State Council for Science & Technology (Tamil Nadu); Chennai respectively, during May 2000- September 2000. A kit to demonstrate the characteristics has been designed and provided to the participating teachers. Around 25 teachers were trained during each workshop.

(v) A 3 day programme on “Learning of Science through Hands-on-activities” was organized by Manipur Science & Technology Council at Imphal. In this programme experiments with low cost teaching/learning aids are explained and demonstrated.
Around 50 experiments based on physics, chemistry & life sciences are covered in this programme. A maximum of 30-35 participants can participate. Similar programme were organized by 1) Science for society, Patna; 2) State Council for Science & Technology (Haryana); 3) State Council for Science & Technology (Bihar); 4) State Council for Science & Technology (Punjab) and 5) State Council for Science & Technology (Rajasthan), respectively during April-September, 2000.

**Science Coverage in Media:**

(i) A training workshop on “Science Writing & Journalism” was organized at Rae Bareilly, U.P., by voluntary organization for Science Communication & Education, Lucknow, U.P., during March 9-12, 2000. The workshop was divided into various technical sessions ranging from development of scripts, techniques of science communication to formats of science writing etc. Over 25 budding science writers attended the four-day workshop. Similar workshops were organized by (i) Swadeshi Science Movement, Kochi, Kerala, at Thiruvananthapuram, during February 10-13, 2000, (ii) Manthan Yuva Sangathan, Ranchi, Bihar, during June 22-25, (iii) Sukanta Academy, Agartala, Tripura during July 12-16, 2000, (iv) Yuva Vigyan Parishad, Gwalior, at Panchamadhi (MP) during August 19-22, 2000 and (v) the Indian Science Communication Society, Lucknow during September 01-04, 2000 at Basti (UP) and during September 30- October 03,2000 at Balarampur (UP) respectively. A training workshop on science fiction writing was organized by the Bhartiya Vigyan Katha Lekhak Samiti at Sarnath, Varanasi, during February 19-22, 2000. Voluntary Institute of Community Applied Science (VICAS), Allahabad, organized 5 workshops on science writing/journalism during June-October, 2000.

(ii) The Enhancement of Science Coverage in Mass Media programme was implemented this year as well. Some 15 workshops were organized during the period February-November, 2000. Over 600 budding science writers/journalists/illustrators were trained. The programme was also extended rural and remote areas.

(iii) Special training programmes were undertaken to develop specialized science writers/illustrators for various media. A workshop on science writing for folk media is being organized at Allahabad. The programme also focused on various formats of science
writing. A workshop on science plays writing was organized at Shivpuri during March 11-14, 2000 and on science fiction writing at Sarnath during February 19-22, 2000.

(iv) A workshop for training of master resource persons for organizing training programmes on science writing/journalism/illustrations was organized by the State Council for Science Technology and Environment, Himachal Pradesh in March, 2000. The programme addressed various issues regarding organization of training programmes.

(v) As a follow-up exercise of training programmes on science writing/journalism, an advanced level training workshop for the participants from earlier workshops, who had shown best performance during last year by way of contributing regularly in mass media in terms of writing science articles/reports, etc. is scheduled to be organized by Yuva Vigyan Parisad, Gwalior at Datia (MP) in December, 2000.

(vi) A one-year training course in science journalism was initiated at Indian Science Communication Society (ISCOS), Lucknow, through distance education from June, 2000.

(vii) A medium term training course in science journalism was sanctioned at Vigyan Parisad, Allahabad, commenced on October 10, 2000 and is expected to continue till January 10, 2001. 50 budding science writers would be trained during the course of the programme. A similar programme is being organized at Kolkata by the Science Association of Bengal.

**Science & Technology Popularization on TV:** Various National Council for Science & Technology Communication (NCSTC) video programmes on frontline areas of science and technology were telecast on educational channel “Gyan Darshan” and Doordarshan’s News Channel under “Darpan” programme during the period March-June, 2000.

**Exhibitions/Fairs/Jathas:** In order to develop creativity and excitement of science and technology among children, several science exhibitions/fairs/festivals were organized, including Midnapore Science Festival (January 26-30, 2000), Regional Science Exhibition, Suri (February 11-15, 2000) and Physics festival “Newtonian” (January 18-19, 2000), Delhi. An exhibition on Science, Technology and Environment was organized by the Centre for Environment Education at Lucknow on the occasion of World Environment Day (June 05, 2000) during the period June 04-12, 2000.
Publications:
(i) “SROTE”, NCSTC’s Science & Technology feature service was undertaken in 1988 by Eklavya, a NGO, based at Bhopal, as an NCSTC project. This was started with a view to enhancing the quantity and quality of science & technology coverage in Hindi newspapers and periodicals, at the same time making available reference materials for teachers, students and others engaged in science & technology communication.
(ii) The project “Preparation of Annotated Bibliography on Popular Science & Technology in Major Indian Languages” was initiated in 1996 covering 14 Indian languages namely Assamese, Bengali, Gujarati, Hindi, Kannada, Malayalam, Manipuri, Nepali, Oriya, Punjabi, Sanskrit, Tamil, Telugu and Urdu. Each bibliography consists of computerized records in English. NCSTC requested State Science & Technology Councils to come forward and join on a 50:50 basis in bringing out their local language computerized editions of the bibliography of popular science books.
(iii) A book titled “Sanchar Madhyamo Ke Liye Vignans Kathayein (Science Fiction for mass media)” in Hindi, containing science fiction, developed during a workshop on science fiction writing, was published by Bharatiya Vigyan Katha Lekhak Samiti, Faizabad, U.P., in June, 2000.

Environmental Awareness:
(i) A year-long plantation activity for schools/science clubs in the form of project root & shoot has been developed. The pilot project has been taken up in March, 2000, in Guna & Ratlam.
(ii) A module to introduce school children to different aspects of Scientific Waste Management through vermicomposting is being developed by the Society for Environment & Development. Delhi, involving Government and Public School children.

2.2.2.30 NCERT’s effort toward a new Curriculum, Science Education in particular:

We have had the opportunity to observe and analyze the strengths and weakness of the National Policy on Education that is in prevalence since 1986. with the benefit of hindsight we can safely conclude that we need to critically scrutinize and revamp the content, process and approach to education, in general and science education, in
particular. Greater dynamism needs to be infused into the school curriculum in order to enable it to respond to the first changing priorities and long-term developmental goals of the nation. A number of important developments have taken place since the last revision of school science curriculum and these are bound to decisively influence the formulation, design and development of science curricula.

Firstly, our understanding of ‘how students learn science’ has changed significantly. From process approach to science education, we have moved to constructivist approach.

Secondly, last two decades have been emergence of a new taxonomy of practical skills, which is now internationally accepted and widely used. These aspects have to be taken care of in design of learning materials for children as well as in the technology of teaching and assessment.

Thirdly, and probably the most significantly, development has taken place in the area of information technology. This is not only likely to considerably influence the end product, but also hugely impact the content and process of science education.

The National Council of Educational Research and Training has already started the process of revising the national curriculum framework. In the first phase, a document entitled ‘National Curriculum Framework for School Education --- A Discussion Document’ has been brought out in January 2000. This document provides a curricular framework for all stages of school education. It has been evolved through a variety of strategies --- by looking into theoretical and research materials, consulting and discussing various issues with faculty members, eminent educationists and experts. In the second phase, workshops / meetings at national / regional levels are being organized for extensive and intensive discussion in order to evolve consensus on various issues raised in the document. The document has been made available to all the stakeholders in education, i.e. other national and state level institutions, school boards of education, state councils of educational research and training, directorates of education, parent/teacher associations, professional associations of teachers and teacher educators, and eminent
educationists and educators. Their suggestions and responses will help enrich the final document. In the third phase, based on the guidelines provided in the new curriculum framework, syllabi, textbooks and other instructional materials for all stages of school science education will be designed and developed.

2.3 **Historical Development of Science Education in Tripura:**

2.3.1 **Historical Background:**

The territory of Tripura has had a very long continued history dating almost from pre-historic times but strangely no information is available on the administration of education in the territory up to the mediaeval times. It is only towards the last quarter of the nineteenth century that we get some information about the state of education prevalent in the territory but that too helps to form a very poor idea about this affair. The report about the education in Tripura as found in the 7Bengal Administration Report for the year 1874-75 shows that the prospect of education in Tripura was far from bright and very little attention was paid to its improvement. The Report observes that “with an estimated population in the plains and in the hills of nearly 75,000 souls, there are about 103 boys undergoing instruction at the two existing schools. The school at Agartala has been in difficulty for the want of funds, which, however, were supplied by the Rajah, at the close of the year.” During the next year, two more schools were opened and in all 173 boys were on the rolls but ‘only one-half’ were regular in their attendance. Obviously, opening of two schools in a year does not indicate any good prospect.

The number of schools on 31st March, 1879 was 25 against 18 on the same date in 1878 and 6 in 1877; the number of pupils attending schools was 700 against 430 in 1878, and 186 in 1877. With the exception of the schools at Agartala all the institutions are Elementary Vernacular Pathsalas. Of the 700 pupils, 30 are the sons of Thakurs, 52 Tipperahs, 232 Manipuris and the remainder (388) Bengali Hindus and Mussalmans. Of 57 girls attending schools, three were Tipperahs and 54 Manipuris.” The number of students, as revealed in the above mentioned report shows that of all communities, the Manipuris were most eager to get their children educated, and the Muslims followed their trail. And it happened so that during the next year all the 64 pupils attending the existing
four girls schools were Manipuris. But as no real interest was evinced by the State Officials in education, the number of pupils began to decrease from 700 in 1878-79 to 668 in 1879-80 and further to 647 in 1880-81, though the number of schools was raised from 28 to 31 at the end of the year 1880-81. This was due to the fact that the teachers were most irregularly paid and there was hardly any supervision of schools which was left with an officer on a salary of Rs. 20 per month.

Due to this lack of interest the number of schools came down to 27 and number of pupils to 609 during the next year. “The caste question had also an unfortunate effect on education as in consequence of the dispute the headmaster of Agurtollah School, the most important institution of the kind in the State, gave up his appointment and his place was still vacant at the close of the year.” During the next two years the state of education further deteriorated; the number of schools came down from 28 in 1882-83 to 15 in 1883-84 and of these for girls from 6 to 2. The number of pupils decreased from 692 to 441. The report states that “the reasons assigned are that these institutions are indifferently looked after and irregularly supported.”

The state of education, prevalent in the State during this period, would be more evident from the fact that “with the exception of the schools at the sub-divisions, all the rest are mere Pathshalas and there was not even a single school in the State raised to the standard of an entrance school. During the next year it was again observed that the highest standard of education imparted in the English and / vernacular schools of the State correspond to those fixed for the minor and vernacular scholarships examinations under the Government rules.”

Up to the year 1889-90 mismanagement of schools continued and some arrangements for the betterment of educational institutions were made during the year 1890-91. The number of schools was raised from 16 to 19 and number of pupils also increased. Another important step for the improvement of educational facilities was taken by upgrading the standard of examination of the English school at Agartala up to the Entrance Examination of the Calcutta University.

Form proceeding No. 19 of 1302 T.E. corresponding to 1892 A.D. it is learnt that in view of the status and economic condition of the common people of the State, residing in places other than the capital, it was taken for granted that only primary education
would be helpful to them and hence to man the Pathsalas, it was decided to hold a special class in the vernacular school of the capital to train the teachers of Pathsalas. It was also stated that the teachers should sit for an examination after completion of training. The successful teachers should then start such Pathsalas in their respective villages. The prospective teachers were to be selected by the villagers themselves. The minimum qualification fixed for such teachers was ability to understand the text of Bodhodaya, a Bengali Primer introduced in primary schools. They were also supposed to be trained up to the standard of class III with special knowledge about agriculture and health keeping. It was further mentioned in the said proceedings that out of 8 trainees, there must be two each from Manipuris, Tripuris and Bengalee communities and two from Kuki and Halam communities.

The salary for these trained teachers was proposed to be as such: They would continue to received Rs. 5/- each as stipend and in addition they would get whatever might be available in the way of income from tuition fees of the students. The proceedings also stressed that to start a Pathsalas, there must be a probability of getting at least 20 students. It was also proposed to appoint one additional Pandit at the vernacular school at Nutan Haveli for training of above mentioned teachers at a monthly salary not exceeding Rs. 20 (Niyam Sangrahahabali; 1302 T.E.).

During the rule of Maharaja Radhakishoremanikya (1896-1909) a new high school, one girls’ school, a few primary schools, one tol and a free boarding school for the children of the royal family and Thakur boys were established. A free second grade college was also started at Agartala in 1901. The college soon acquired first grade status but it had a closed down within a few years because the policy of the authorities of the Universities of Calcutta was against the establishment of such institutions in small towns in the mofussil.

But inspite of these attempts made by the ruler the position did not improve much during the next few years as will be evident from the following account.

10 Education is very backward, and in 1901 only 2.3% of the population could read and write. In 1903, the number of pupils under instruction was 3,125 (boys 3,008 and girls 117). The number of schools in the year was 103, including an arts college, a secondary school, 99 primary schools and two special schools The Maharaja, however,
took keen interest in the advancement of education, particularly among the backward communities and provided cash reward to each tribal child attending school. A reward examination was also held in winter at several centers. The successful candidates as well as the teachers used to receive monetary rewards immediately after the examination. Besides the hill scholarship, a good number of stipends were also provided to the deserving students for higher education. In this connection it may also be mentioned that education in all stages had been free in Tripura up to 1915-16 and “with a view to encourage self-help and also to make provision for the various needs of students”, a scale of fees was introduced only in three existing high English schools from the beginning of the year 1916-17. It may be pointed out that except the high English schools all other kinds of schools were free and even in high schools the indigenous inhabitants of the State, e.g. the Thakurs, the Tripuris, the Manipuris and other hill people were exempted from paying fees.\footnote{11}

During 1916-17 some principles were laid down in regard to the medium of instruction. It was stated, “In the M.E. and other lower schools teaching English, the medium of instruction shall be the vernacular language except in the case of arithmetic, geography and English where Anglo-Vernacular textbooks would be of greater help to students, English being taught as a second language. And from class VII upwards in the H.E. schools all instructions to be given through the medium of English language.”

But still the enrolment in primary schools did not come up appreciably. The administration took it as apathy on the part of the parents who were not at all interested in schooling of their children. A circular was, however, issued in 1920 from the Department of Education, urging upon the Darogas, Nayabs and Tehsildars to take special interest in the matter of increasing the number of students and helping the teachers and inspecting staff in meeting the requirements of the schools.\footnote{12}

A circular was issued by the Education Department in 1931 fixing admission fees and tuition fees for children reading upto class II. The circular stated that free studentship seemed to be the cause of dropout among the students. The Tripuris, Manipuris, Thakur boys and Princes were, however, exempted from paying such fees. Next year, it was decided that annas four will be charged as admission fees in Pathsalas and Lower
Vernacular Schools and annas eight will be charged as admission fees in Minor and high school from class III to V and annas four for classes below III.

2.3.2 Tripura emerges first in North-East with Satellite-Based Education:

With the inauguration of the EDUSAT network at the State Council of Education Research and Training (SCERT), Tripura has emerged as the first among northeastern states to have satellite-based educational facilities. The launch of EDUSAT has ushered in an era where both internet and intranet can be used for transmission, interaction, dialogue, digital repositories, digital multimedia content and for virtual education and research. At present there are 50 Satellite Interactive Terminals (SIT) in Tripura, and these will double within the next few years.

2.3.3 Satellite Based Education: EDUSAT

The mission of total literacy, compulsory education for all in the age group of 6-14 years and requirement of massive training of untrained teachers propelled the policy makers and media administrators to augment satellite mediated interactive learning. An indigenously built exclusive educational satellite (Edusat) was put in the geostationary orbit on September 20, 2004. Edusat carries five Ku-band transponders with spot beams covering Northern, North-eastern, Eastern, Southern and Western regions, one Ku-band transponder with its foot prints covering the entire country. Its most remarkable feature is its capability to connect all schools/colleges/universities and developmental agencies across the country via point-to-point Receive Only Terminals, ROTs (1A, 1V) as well as Satellite Interactive Terminals through multi teaching end (2A, 2V). As of now, national institutions like IGNOU, NCERT and regional institutions like SOUs have established their PC-based interactive networks using web camera and the facility is functional for video-conferencing (2A, 2V). IGNOU has established two national networks: one for primary education and teacher training with teaching end at Jabalpur and the other for distance learners with teaching end at EMPC, IGNOU. About 1200 schools in four districts, one each in Chattisgarh, Bihar, Madhya Pradesh and Uttar Pradesh were initially connected and the network is being operated successfully.
2.3.4 Edusat network in Tripura:

“Edusat” is a satellite dedicated exclusively for educational purpose. It was launched by Indian Space Research Organization (ISRO) in the orbit on 20\textsuperscript{th} September, 2004.

Tripura is the first in the north-east region to launch the Edusat Programme. The Edusat Network in Tripura was inaugurated on 14\textsuperscript{th} August 2007 at SCERT, Abhoynagar, Agartala. ISRO has provided required bandwidth on Edusat satellite Transponder for Edusat Network in Tripura.

2.3.4.1 The objectives of Launching Edusat in the State are:

(i) Use the most modern techniques of multimedia tele-teaching/learning.
(ii) To use the Network for large number of students/trainees located at dispersed locations.
(iii) Best resource persons are available for the target groups through centrally located teaching end.
(iv) To generate great amount of interest and attention level among the participants at dispersed locations.
(v) To develop the competency of the teachers through teacher training.
(vi) It generates great amount of interest among the target groups due to the element of interactivity involved and use of animation, video clipping and multimedia to bring clarity in the concepts.

2.3.4.2 The present status of the network:

(i) Hub station (Centre of Edusat Network) and studio have already been installed at SCERT, Aboynagar and are functional.
(ii) 50 Satellite Interactive Terminals (SITs) have been identified and equipments already installed and made functional.
At present all SITs are functional except the SITs at Kailasahar DIET (non functional as electricity supply has been cut off), Chawmanu7 BRC, Killa BRC & Ledrai Dewan BRC (non functional due to equipments being stolen).

(iii) 4 Technical Persons, 1 Electrician, 1 Artist and 1 Cameraman have been engaged on contract for one year as per suggestion of Indian Space Research Organization (ISRO).

(iv) To operate the machine at SITs, 2 assistant teachers from each SIT have been engaged and they have been trained by ISRO at SCERT, Agartala.

(v) SCERT has communicated with North East Regional Institute of Education (NERIE) & NCERT for supporting the SCERT providing resource persons for teachers training in the State.

(vi) Works related to Content Generation is under process. In this connection it may be mentioned that Development of Educational Communication Unit (DECU), ISRO, Ahmedabad has conducted a 5-day training programme of 22 resource persons selected from various Higher Secondary Schools and DIET Agartala on content generation from 8th-13th June, 2007 in collaboration with SCERT.

(vii) Teachers training programme has been started for primary & upper primary teachers under SSA (Sarva Siksha Abhiyan) intervention.

(viii) Besides teachers training, we have started classes on different subjects (Beng., Eng., Math., Science, History and Geography) for the students of various high and higher secondary schools.

(ix) To run the EDUSAT training programme smoothly the following committees have been constituted in the SCERT:

(a) State Level Monitoring Committee and (b) Working Group

(x) For 24-hour security at HUB & studio at SCERT, three securities personal have been engaged through out sourcing.

(xi) For special type of electrification (such as Earthing) in SITs, all Head of the Institutions have been requested to take necessary steps.
2.3.5 Computer Education & Computer Aided Learning (CAL) in Tripura:

There are 3,879 numbers of schools in Tripura. The break up of these schools is given below:

**TABLE: 2.1  Total no. of Schools in Tripura**

<table>
<thead>
<tr>
<th>Type of the school</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Secondary Schools</td>
<td>293</td>
</tr>
<tr>
<td>High Schools</td>
<td>424</td>
</tr>
<tr>
<td>Senior Basic Schools</td>
<td>1,020</td>
</tr>
<tr>
<td>Junior Basic Schools</td>
<td>2,142</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,879</strong></td>
</tr>
</tbody>
</table>

Out of the 717 High & Higher Secondary Schools, 200 schools have been covered for Computer Education (including CAL) under different Schemes as stated below:

**TABLE: 2.2  Computer covered Schools**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Scheme</th>
<th>Year of starting the scheme</th>
<th>Number of schools covered (High/HS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Revised Class Project</td>
<td>2004-05</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>ICT @ School Project</td>
<td>2007-08</td>
<td>150</td>
</tr>
</tbody>
</table>

**2.3.5.1 ICT @ School Project:**

The MHRD has sanctioned fund for introduction of ICT @ School Project in Tripura for the year 2007-08. Accordingly, the work has been distributed among four implementing agencies through inviting of tender and 150 schools have been covered under this project as indicated above. This is being implemented on BOOT (Build, Own, Operate and Transfer) basis. Under this project, the following computer and its peripherals have been supplied to each school:
### TABLE: 2.3 ICT School Projects

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Computer (Nodes 09 + Server 01)</td>
<td>10 nos</td>
</tr>
<tr>
<td>2</td>
<td>UPS 600 VA for each computer</td>
<td>10 nos</td>
</tr>
<tr>
<td>3</td>
<td>Printer</td>
<td>01 no</td>
</tr>
<tr>
<td>4</td>
<td>Software</td>
<td>01 no</td>
</tr>
<tr>
<td>5</td>
<td>HUB/Switch</td>
<td>01 no</td>
</tr>
<tr>
<td>6</td>
<td>Computer tables</td>
<td>10 nos</td>
</tr>
<tr>
<td>7</td>
<td>Chairs</td>
<td>20 nos</td>
</tr>
<tr>
<td>8</td>
<td>Printer table</td>
<td>01 no</td>
</tr>
<tr>
<td>9</td>
<td>Ceiling fan</td>
<td>02 nos</td>
</tr>
<tr>
<td>10</td>
<td>Tube lights</td>
<td>02 nos</td>
</tr>
<tr>
<td>11</td>
<td>Instructor table</td>
<td>01 no</td>
</tr>
<tr>
<td>12</td>
<td>Instructor Chair</td>
<td>02 nos</td>
</tr>
<tr>
<td>13</td>
<td>Electric Sub-meter</td>
<td>01 no</td>
</tr>
<tr>
<td>14</td>
<td>False ceiling</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Vinyl Flooring</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Networking cabling with suitable wall outlets</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Electrical wiring</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Paint for the Computer Lab</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>E-learning content</td>
<td></td>
</tr>
</tbody>
</table>

#### 2.3.5.2 Eleventh Finance Commission:

8 (eight) Higher Secondary Schools have been covered under this project. Through this project, 10 (ten) computers, 10 (ten) UPS and 1 (one) Printer have been supplied to each school.
2.3.5.3 NEC Project:

North Eastern Council has supplied Computer and its peripherals in 97 Higher Secondary Schools in Tripura. For this purpose, NEC has supplied 10 (ten) computers, 2 (two) UPS and 2 (two) printers for each school. NEC calls regular teachers for computer training at Shillong. SCERT is not aware of this programme as NEC communicates directly with the schools.

2.3. 5.4 Action plan for the period of 4 (four) years:

High & Higher Secondary Schools:

The ICT @ School Project has been introduced in another 250 high & higher secondary schools in the State in the year 2008-09. For this purpose MHRD had sanctioned fund for 250 schools (150 in the year 2007-08 + 250 in the year 2008-09 = 400) and communicated the same. The rest 317 High & Higher Secondary Schools (717-400) has been covered under ICT @ School Project during the year 2009-10.

Upper Primary School:

Steps have been taken to introduce Computer Aided Learning covering upper primary schools including far-flung areas in the state. An amount of Rs. 7.00 lakh may be required for each Primary and upper primary school as per norms of MHRD.

All the independent senior basic schools 1020 have been covered by phases in three years (250 during 2008-09) balance in next two years. Seven (07) computers had been provided per school like SSA programme.

In three years we have cover 1020 Upper Primary Schools in the following manner:

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Year</th>
<th>No. of upper primary schools</th>
<th>Cost of installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2008-09</td>
<td>250</td>
<td>250 x Rs.7 lakh = Rs. 1750 lakh</td>
</tr>
<tr>
<td>2</td>
<td>2009-10</td>
<td>350</td>
<td>350 x Rs.7 lakh = Rs. 2450 lakh</td>
</tr>
<tr>
<td>3</td>
<td>2010-11</td>
<td>420</td>
<td>420 x Rs.7 lakh = Rs. 2940 lakh</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1020</td>
<td>Rs. 7140 lakh</td>
</tr>
</tbody>
</table>
### TABLE: 2.5 Priority List of Tripura (2007-08)

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Name of the Project</th>
<th>Department</th>
<th>Project Cost (Rs. in Lac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upgradation of infrastructure of 25Upper Primary School building with provision of furniture (Phase II)</td>
<td>School Education</td>
<td>369.00</td>
</tr>
<tr>
<td>2</td>
<td>Renovation and upgradation of Kailashahar Government Girl’s H.S. School and Boarding house</td>
<td>School Education</td>
<td>525.00</td>
</tr>
<tr>
<td>3</td>
<td>Construction of Pucca building of 175 Primary School with provision of furniture (Phase II)</td>
<td>School Education</td>
<td>1444.00</td>
</tr>
<tr>
<td>4</td>
<td>Auditorium of the Sukanta Academy for Science, Arts and Culture</td>
<td>ST &amp; Environment</td>
<td>250.00</td>
</tr>
<tr>
<td>5</td>
<td>Infrastructure development of Dhamma Dipa School, Manu Bankul Sabroom, South Tripura</td>
<td>School Education</td>
<td></td>
</tr>
</tbody>
</table>

### 2.3.6 Development of Science and Technology in NER:

The Central Government provides financial assistance for development and promotion of science and technology in the North- Eastern Region (NER) under various programmes such as science and engineering research, science communication, natural resource data management system, science and society, state science and technology programme, bio-technology etc. The projects approved are based on the proposals received from various institutions in the states. In addition to these R&D projects, Government provides financial support to various State Councils for Science and Technology for development and promotion of science and technology in the respective states. The areas identified include strengthening science education, bio-resource technology, energy, meteorology mapping, health care, and bamboo processing and disaster management.
### TABLE: 2.6 State-wise sponsored R&D Projects
(Amount in lakh Rupees)

<table>
<thead>
<tr>
<th>Sl no</th>
<th>State/UT</th>
<th>2002-03</th>
<th>2003-04</th>
<th>2004-05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of projects</td>
<td>Approved cost</td>
<td>No. of projects</td>
</tr>
<tr>
<td>1</td>
<td>Arunacha Pradesh</td>
<td>13</td>
<td>101.99</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Assam</td>
<td>62</td>
<td>773.66</td>
<td>61</td>
</tr>
<tr>
<td>3</td>
<td>Manipur</td>
<td>6</td>
<td>69.17</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Meghalaya</td>
<td>9</td>
<td>199.01</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Mizoram</td>
<td>2</td>
<td>27.03</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Nagaland</td>
<td>3</td>
<td>45.15</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Sikkim</td>
<td>2</td>
<td>25.66</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Tripura</td>
<td>4</td>
<td>49.91</td>
<td>5</td>
</tr>
</tbody>
</table>

### TABLE: 2.7 State Science & Technology Programme
(Amount in lakh Rupees)

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>State/UT</th>
<th>2003-04</th>
<th>2004-05</th>
<th>2005-06</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arunacha Pradesh</td>
<td>39.40</td>
<td>70.92</td>
<td>23.45</td>
</tr>
<tr>
<td>2</td>
<td>Assam</td>
<td>47.81</td>
<td>53.03</td>
<td>39.30</td>
</tr>
<tr>
<td>3</td>
<td>Manipur</td>
<td>56.00</td>
<td>47.74</td>
<td>47.76</td>
</tr>
<tr>
<td>4</td>
<td>Meghalaya</td>
<td>16.00</td>
<td>9.00</td>
<td>8.42</td>
</tr>
<tr>
<td>5</td>
<td>Mizoram</td>
<td>19.00</td>
<td>19.50</td>
<td>35.50</td>
</tr>
<tr>
<td>6</td>
<td>Nagaland</td>
<td>----</td>
<td>20.00</td>
<td>11.50</td>
</tr>
<tr>
<td>7</td>
<td>Sikkim</td>
<td>28.30</td>
<td>13.36</td>
<td>36.50</td>
</tr>
<tr>
<td>8</td>
<td>Tripura</td>
<td>20.00</td>
<td>24.50</td>
<td>42.00</td>
</tr>
</tbody>
</table>

### TABLE: 2.8 Department wise Approved Projects and Funds
Department wise approved projects and funds released by Government of India under one time ACA during Annual Plan 2004-05
(Amount in lakh Rupees)

<table>
<thead>
<tr>
<th>Department</th>
<th>Name of Project</th>
<th>Approved Cost</th>
<th>Released by GOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science, Technology &amp; Environment</td>
<td>Journey to the Sun via Mars at Sukanta Academy Complex, Agartala</td>
<td>97.66</td>
<td>97.66</td>
</tr>
<tr>
<td>School Education</td>
<td>Upgradation of infrastructure of 6 nos. of Higher Secondary Schools &amp; 5 nos. of High Schools</td>
<td>604.50</td>
<td>604.50</td>
</tr>
<tr>
<td>Higher Education</td>
<td>Development of Science Block at Women’s College, Agartala</td>
<td>150.00</td>
<td>150.00</td>
</tr>
</tbody>
</table>
2.3.7 Educational scenario in Tripura at a glance (2005-06):

TABLE: 2.9  Educational Scenario in Tripura

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>State literacy rate:</td>
<td>73.20% (Country literacy rate: 65.38%)</td>
</tr>
<tr>
<td>Male literacy rate:</td>
<td>81% (Country Male literacy rate: 75.85%)</td>
</tr>
<tr>
<td>Female literacy rate:</td>
<td>64.9% (Country Female literacy rate: 54.16%)</td>
</tr>
<tr>
<td>Schedule Caste literacy rate:</td>
<td>74.70%, Male: 81.90%, Female: 67.20%</td>
</tr>
<tr>
<td>Schedule Tribe literacy rate:</td>
<td>56.50%, Male: 68.00%, Female: 44.60%</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Junior Basic School (including ADC):</td>
<td>1989</td>
</tr>
<tr>
<td>Number of Senior Basic School (including ADC):</td>
<td>1004</td>
</tr>
<tr>
<td>Number of Secondary School (including ADC):</td>
<td>423</td>
</tr>
<tr>
<td>Number of Higher Secondary School (including ADC):</td>
<td>248</td>
</tr>
<tr>
<td>Number of Higher Secondary School (with Science):</td>
<td>107</td>
</tr>
<tr>
<td>Number of Junior Basic School under ADC:</td>
<td>1349</td>
</tr>
<tr>
<td>Number of Senior Basic School under ADC:</td>
<td>181</td>
</tr>
<tr>
<td>Number of Secondary School under ADC:</td>
<td>139</td>
</tr>
<tr>
<td>Number of Higher Secondary School under ADC:</td>
<td>50</td>
</tr>
<tr>
<td>Number of Girl’s School in the State:</td>
<td>49</td>
</tr>
<tr>
<td>Number of English Medium School in the State:</td>
<td>74</td>
</tr>
<tr>
<td>Number of Madrasa in the State:</td>
<td>130</td>
</tr>
<tr>
<td>Number of Teacher in the State:</td>
<td>33110</td>
</tr>
</tbody>
</table>

TABLE: 2.10  Year wise number of different types of School

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>1991</td>
<td>1987</td>
<td>1687</td>
<td>1781</td>
<td>1349</td>
</tr>
<tr>
<td>Urban</td>
<td>89</td>
<td>89</td>
<td>89</td>
<td>68</td>
<td>517</td>
</tr>
<tr>
<td>Total</td>
<td>2089</td>
<td>2076</td>
<td>1776</td>
<td>1849</td>
<td>1866</td>
</tr>
</tbody>
</table>
### Senior Basic School

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>398</td>
<td>422</td>
<td>970</td>
<td>970</td>
<td>982</td>
</tr>
<tr>
<td>Urban</td>
<td>30</td>
<td>30</td>
<td>31</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>428</td>
<td>452</td>
<td>1001</td>
<td>1004</td>
<td>1004</td>
</tr>
</tbody>
</table>

### Secondary School

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>373</td>
<td>382</td>
<td>383</td>
<td>375</td>
<td>390</td>
</tr>
<tr>
<td>Urban</td>
<td>31</td>
<td>27</td>
<td>26</td>
<td>82</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>404</td>
<td>409</td>
<td>409</td>
<td>457</td>
<td>423</td>
</tr>
</tbody>
</table>

### Higher Secondary School

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>166</td>
<td>168</td>
<td>168</td>
<td>162</td>
<td>164</td>
</tr>
<tr>
<td>Urban</td>
<td>70</td>
<td>74</td>
<td>75</td>
<td>83</td>
<td>84</td>
</tr>
<tr>
<td>Total</td>
<td>236</td>
<td>242</td>
<td>243</td>
<td>245</td>
<td>248</td>
</tr>
</tbody>
</table>

**TABLE: 2.11** District wise number of Educational Institution, Enrolment & Teacher

**District wise number of Educational Institution, Enrolment & Teacher (2005-06)**

### Junior Basic School

<table>
<thead>
<tr>
<th>District</th>
<th>Educational Institution</th>
<th>Enrolment</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>639</td>
<td>215787</td>
<td>3567</td>
</tr>
<tr>
<td>North</td>
<td>258</td>
<td>89017</td>
<td>864</td>
</tr>
<tr>
<td>South</td>
<td>605</td>
<td>138015</td>
<td>1942</td>
</tr>
<tr>
<td>Dhalai</td>
<td>364</td>
<td>57465</td>
<td>975</td>
</tr>
<tr>
<td>Total</td>
<td>1866</td>
<td>500284</td>
<td>7348</td>
</tr>
</tbody>
</table>

### Senior Basic School

<table>
<thead>
<tr>
<th>District</th>
<th>Educational Institution</th>
<th>Enrolment</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>343</td>
<td>100108</td>
<td>3842</td>
</tr>
<tr>
<td>North</td>
<td>278</td>
<td>32947</td>
<td>1742</td>
</tr>
<tr>
<td>South</td>
<td>227</td>
<td>46843</td>
<td>1939</td>
</tr>
<tr>
<td>Dhalai</td>
<td>156</td>
<td>17288</td>
<td>916</td>
</tr>
<tr>
<td>Total</td>
<td>1004</td>
<td>197186</td>
<td>8439</td>
</tr>
</tbody>
</table>
### Secondary School

<table>
<thead>
<tr>
<th>District</th>
<th>Educational Institution</th>
<th>Enrolment</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>195</td>
<td>47412</td>
<td>4482</td>
</tr>
<tr>
<td>North</td>
<td>76</td>
<td>14322</td>
<td>1220</td>
</tr>
<tr>
<td>South</td>
<td>113</td>
<td>21597</td>
<td>2009</td>
</tr>
<tr>
<td>Dhalai</td>
<td>39</td>
<td>6824</td>
<td>611</td>
</tr>
<tr>
<td>Total</td>
<td>423</td>
<td>90155</td>
<td>8322</td>
</tr>
</tbody>
</table>

### Higher Secondary School

<table>
<thead>
<tr>
<th>District</th>
<th>Educational Institution</th>
<th>Enrolment</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>124</td>
<td>19199</td>
<td>5149</td>
</tr>
<tr>
<td>North</td>
<td>40</td>
<td>4470</td>
<td>1429</td>
</tr>
<tr>
<td>South</td>
<td>63</td>
<td>6968</td>
<td>1832</td>
</tr>
<tr>
<td>Dhalai</td>
<td>21</td>
<td>1976</td>
<td>581</td>
</tr>
<tr>
<td>Total</td>
<td>248</td>
<td>32613</td>
<td>8991</td>
</tr>
</tbody>
</table>

**2.3.8 Development of Education in NER:**

Following steps have been taken by the Central Government to promote and develop Human Resource in the North Eastern Region:

(i) Strengthening of State Council for Education Research and Training (SCERT),

(ii) For untrained teachers, a special diploma programme called Diploma in Primary Education (DPE) has been launched jointly by IGNOU and NCERT,

(iii) Central intervention in the secondary education sector in NER has been made for improvement of science education, vocationalisation of education, assistance to NGOs for strengthening hostel facilities for girl student and also for integrated education of disabled children,

(iv) Out of 55 District Institute of Education and Training (DIET) sanctioned for pre-service training to elementary school teachers, 32 have become operational in the NER and
(v) District Primary Education Programme (DPEP) with financial assistance from the World Bank and European Union, is being implemented in Assam covering all 9 districts having low female literacy rate.

2.4 **Development of Science Education in Primary Level:**

2.4.1 **Compulsory Primary Education, a historical background:**

A very bold step seemed to have been taken by the administration in 1931-32 when compulsory primary education was introduced in the State capital, Agartala, under the State Act 2 of 1932. But as the scope of the Act was confined only to the municipal area of the town covering the students of only four primary schools for all practical purposes, it is doubtful whether the Act served any real purpose. After five years it was decided to expand its scope upto the valley of Howrah and to the linked areas of the Sub-divisional town.

But from the table given below it will be evident that the educational facilities even at the primary stage did not increase in proportion to the increase in population.

**TABLE: 2.12  Percentage of Primary School going Children**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of schools</th>
<th>Number of pupils</th>
<th>Percentage primary children to total school going children</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907-08</td>
<td>137</td>
<td>4011</td>
<td>18.5</td>
</tr>
<tr>
<td>1916-17</td>
<td>125</td>
<td>4842</td>
<td>16.5</td>
</tr>
<tr>
<td>1926-27</td>
<td>139</td>
<td>4215</td>
<td>10.6</td>
</tr>
<tr>
<td>1936-37</td>
<td>111</td>
<td>5110</td>
<td>7.9</td>
</tr>
<tr>
<td>1943-46</td>
<td>123</td>
<td>5115</td>
<td>7.9</td>
</tr>
</tbody>
</table>

The anomaly between the increase in number of pupils and decrease in the percentage may be due to exaggeration of figures upto the twenties but that does not disprove that educational facilities remained almost static during this long period.

The progress in the field of general education has all the more been remarkable. It has already been stated that little attention was paid towards the growth of primary education during the time of the Maharajas. Even in 1945-46, there were only 123 primary schools, mostly with classes I and II in Tripura. The total enrolment was about 5,115, thus covering only 7.9% of the school-going children of primary stage age-group.
But even this number does not give the real picture of the condition of education prevailing at that time. Because, it is not gainsaid that “the primary schools, whatever their numbers, functioned more in name and as emblems of royal dispensations than as any stable foundation for educational growth and this state of affairs continued upto the merger of this princely State with the Union of India in October, 1949 and even for quick some time after merger.”

From the table given below, it will be evident that proper action towards the systematic development of education in the territory was first taken during the First Five Year Plan period and since then it gained such a momentum year by year that the percentage of average of school-going children of the age-group 6-11 years rose to 80.8 during the year 1964-65.

**TABLE: 2.13  Percentage of Average of School going Children**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Institution (Primary, Basic &amp; non-Basic)</th>
<th>Students</th>
<th>Percentage coveragae</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>404</td>
<td>19,155</td>
<td>24.8</td>
</tr>
<tr>
<td>1955-56</td>
<td>1,001</td>
<td>54,053</td>
<td>54.1</td>
</tr>
<tr>
<td>1960-61</td>
<td>1,074</td>
<td>81,358</td>
<td>60.7</td>
</tr>
<tr>
<td>1964-65</td>
<td>1,359</td>
<td>1,20,304</td>
<td>80.8</td>
</tr>
</tbody>
</table>

By the end of the year 1964 there were altogether 1,333 primary schools including 600 junior basic schools in this territory and of these 1,317 were under management of the administration and the rest under private management. The total enrolment at the primary stage of all types of schools was 1, 15,369, the number of girl students being 42,087, forming over 36% of the total. The total number of teachers was 3,411 and of them 1,072 happened to be trained.

The total expenditure on primary education during the next year 1960-61 was Rs. 47.27 lakhs forming about 35% of the total expenditure on education in this territory during the year. The per capita cost was Rs. 47.83 (direct expenditure only) and the teacher-pupil ratio in general was 1:35. By the end of 1964-65 only the direct total expenditure on primary education rose to Rs. 53, 91,878 and the per capita cost amounted to Rs. 45. The teacher-pupil ratio became 1:33 during the same period.
The senior basic schools run classes’ upto VIII standard and their distinctive features as also of all other basic schools consist in their greater stress on craft (activity-centered) and correlated teaching than on bookish knowledge. All the senior basic schools are co-educational and impart free tuition. During the year 1963-64 there were altogether 102 senior basic schools in this territory.

2.4.2 Educational Development in the North-Eastern Region:

There are a number of interventions which the department has been carrying out in the North-Eastern region. There is a high percentage of untrained teachers in the North-Eastern Region (35%). A special diploma programme called “Diploma in Primary Education” (DPE) for untrained school teachers of North-Eastern Region has been launched jointly by IGNOU and NCERT. Centrally sponsored schemes of Operation Blackboard (OB), Non Formal Education (NFE) and Teacher Education (TE) are also being implemented in most North-Eastern States. The District Primary Education Programme (DPEP) is being implemented in 9 districts of Assam.

2.4.3 Stages of School Education in India:

The primary stage consists of classes I-V, i.e., of five year during duration, in 20 States/UTs namely Andra Pradesh, Arunachal Pradesh, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Manipur, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Andaman & Nicobar Islands, Chandigarh, Delhi and Karaikal and Yanam regions of Pondicherry. The primary stage consists of classes’ I-IV in Assam, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Meghalaya, Mizoram, Nagaland, Dadra & Nagar Haveli, Daman & Diu, Lakshaweep and Mahe region of Pondicherry.

2.4.4 Content Development:

At the primary stage science is taught under the umbrella of Environmental Studies. The contents are thematically organized into chapters titled: Things around plants; Animals and us; our body and Food, health and weather. The syllabus concludes with a chapter titled: Man, Science and Environment.
Science education imparted to the students at the upper primary stage ought to form part of a smooth and seamless transition from the ‘environmental studies approach’ to a more formal study of science. With this as the guiding principle, efforts have made to formulate content and approach.

**2.5 Development of Science Education in Secondary & Higher Secondary Level:**

**2.5.1 Secondary Education, a historical background:**

The picture at the secondary stage was also not very bright. Agartala High School which was established in 1890 and renamed as Umakanta Academy in 1904 after the name of Rai Bahadur Umakanta Das, the late Minister of Tripura, renamed the only high school in the State upon the year 1916 with two feeder institutions at Bilonia and Kailasahar, running up to the eighth grade. Besides, there were 4 Middle English Schools and two High Vernacular Schools for boys and one Middle English School (converted from High Vernacular School since the beginning of the year 1915-16) for girls, namely Maharani Tulshibati Girls’ School during the same period. The B.K.Institution at Bilonia and the R.K. Institution at Kailasahar were raised to the standard of High English School during the next year. The number of High English School in the State rose to five in 1925-26 as two other schools, one each at Dharmanagar and Sonamura were opened.

That there had not been any appreciable expansion of secondary education in the State during the next two decades is evident from the fact that during 1935-36 the number of high school remained 5 as before with addition of only one branch school up to the ninth grade at Udaipur.

The number of Middle School for boys, however, rose from four to ten only during this period. The position did not improve much during the next decade and as a result, “till 1943 the State had not a single girl’s school. At the time of accession, the State had nine secondary schools in all with an enrolment of 2397 pupils.” Unlike at the primary stage, no privately managed schools existed at the middle and secondary stages of education.
2.5.1.1 Secondary Education – High schools:

An idea of rapid expansion of education at the secondary stage in Tripura may also be had from the fact that even as late as 1947, there were only 9 High Schools including one for girls in the whole territory and the total enrolment was about 500, girls forming a very low percentage of the total. During the year 1953-54 there were in all 31 high schools including 8 for girls in this territory.

2.5.1.2 Schemes and programmes:

The development of secondary education sector is guided by the following Centrally Sponsored Schemes:
1. Integrated Education for Disabled Children
2. Improvement of Science Education in Schools
3. Promotion of Yoga in Schools
4. Strengthening Boarding and Hostel Facilities for Girls
5. Environmental orientation to School Education.

2.5.1.3 Improvement of Science Education in Schools:

With a view to identifying a nurturing talent in mathematics, physics and chemistry at school level, the International Mathematical Olympiad (IMO), Internal Physics Olympiad (IPhO) and International Chemistry Olympiad (IChO) is held every year. India has been participating in these Olympiads since 1989, 1998 and 1999 respectively. Each participating country is required to send a team comprising not more than 6 secondary student contestants to IMO, 5 secondary student contestants at IPhO and 4 contestant students to IChO apart from a leader and deputy team leader.

2.5.1.4 Educational Development in the North-Eastern Region:

Central interventions in the secondary education sector in the North East have been improvement of science education, environmental orientation to school education,
vocationalisation of education, assistance to NGOs for strengthening boarding/hostel facilities for girl students and integrated education for disabled children.

2.5.1.5 Developing curricular materials of Science for the Secondary level:

The guidelines which were developed by NCERT (1986-87) for developing science curriculum materials are given below:

(i) Syllabus in science should develop formal operational thoughts in the child to solve problems. In order to help a child to become a formal operational thinker, he/she should be allowed to explore and find relations or patterns. Stress should be laid on quantification of ideas and precision of measurement.

(ii) The learner should be able to grasp the basic structure and principles of science and be able to relate science with agriculture, industry, energy, environment, health and contemporary areas of national development.

(iii) It is necessary to identify areas where the knowledge, competency and skills of science would be used. Some such areas are the human body, health, nutrition, disease, food, environment, communication and agriculture. Competency and skills to be developed in these areas may be identified.

(iv) Basic scientific principles and problems in each of these areas may be identified.

(v) On the basis of what the pupils have learnt up to class VIII, consolidation and reinforcement are to be made so that the pupils may understand the issues and problems and develop ability to approach these problems through scientific method.

(vi) Instead of attempting to load the pupil with the information from all the contemporary disciplines, science syllabus should help the child to learn the key concepts which cut across all the disciplines.

(vii) As the present science curriculum is child centred, sufficient elements are to be provided to help an individual to question the superstitions, obscurantism, misbelieve and prejudices, prevailing in the society. It must hold to realize the underlying biological unity of human beings so that one can see beyond the barriers of races, colour, caste, language and narrowness in thinking of different kinds.
(viii) Both the beneficial and harmful prospects of science are to be presented. While appreciating the utilitarian aspects of science, the child must be aware of the misuse of science, such as, harmful effects of nuclear holocaust tampering with the environment.

(ix) The ever expanding horizon of science, through not apparent, at times, captures the young mind and help in developing aesthetic appreciation.

(x) The syllabus of science curriculum must have Operational link with the various co-curricular and extra curricular activities. Activities like field trips, nature’s trail, working on some project, bee-keeping, gardening, photography, sky watching etc. has both educational and recreational values.

(xi) The learning at secondary stage should help in providing some scientific base for a large number of technicians and other skilled persons. Therefore, emphasis may be laid on developing of awareness of the inter-dependence between science and technology.

2.5.1.6 Stages of School Education in India:

The middle stage of education comprises classes VI-VIII in as many as 18 States/UTs viz., Arunachal Pradesh, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Manipur, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Andaman & Nicobar Islands, Chandigarh, Delhi and Karaikal region of Pondicherry; classes V-VII in Assam, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Meghalaya, Mizoram, Dadra & Nagar Haveli, Daman & Diu, Lakshaweep and Mahe region of Pondicherry and classes VI-VII in Andra Pradesh, orissa and Yanam region of Pondicherry. In Nagaland classes V-VIII constitute the upper primary stage.

2.5.1.7 Content Development:

The organization of concepts in Class VI is somewhat similar to those of the lower primary. In Class VII and VIII, subject matter is dealt with at greater length. Themes like Science in everyday life; Things around us; Changes around us; Measurement; Separation of Substances; The living world; The living body; Air, water and energy; Balance of nature and The Universe, make up the course material that engage the students at Class VI. This is followed in class VII and VIII by more subject oriented
themes such as Mechanics; Heat; Electricity; Magnetism; Carbon and its compound; Metals and non-metals; Life process; Evolution etc., interdisciplinary topics like Health, Nutrition and Agriculture also constitute integral part of the subjects taught at this stage.

Science, at the secondary stage, is introduced around ten themes, such as: Matter, nature and behaviour; Motion; Force and energy; Ways of living; Human beings; World of work; Energy; Food and health; Environment; Natural resources and the universe. The time allotted for teaching science at primary, upper primary and secondary stage is 15%, 12% and 13% respectively of the total instructional time.

2.5.2 Development of Science Education in Higher Secondary level:

2.5.2.1 Higher Secondary Education:

By the end of the year 1963-64 Tripura has come to have 23 multipurpose higher secondary and 26 class X high schools; 8 of the former and 7 of the later being solely for girl students. 11 other higher secondary and 15 class X high schools have co-education and the rest for boys only. Besides, there are 34 junior high schools, including 2 for girls, teaching up to class VIII standard. Agartala town has as many as 9 multipurpose higher secondary schools, 5 class X high schools and 3 junior high schools. Of the sub-divisions, Amarpur, Sabrum, Kamalpur and Sonamura have each a class X high schools at their headquarters. Bilonia has two boys’ higher secondary schools and 1 girls’ high school in town and 1 higher secondary and 1 high school in the rural area. Udaipur Sub-division has 1 boys’ higher secondary, 1 boys’ and 1 girls’ high schools at the headquarters town and 1 higher secondary school in rural area. Sonamura has 1 high school and 1 girls’ junior high school in the town and another higher secondary school in rural area. Besides those at Agartala town mentioned above, the Sadar Sub-division has 5 high schools, 1 higher secondary and 11 junior high schools in rural area. In the Khowai Sub-division there are 1 higher secondary, 2 high schools in the town and 1 higher secondary and 2 junior high schools in mofussil area. In addition to 1 higher secondary school and 1 high school in the town, Kamalpur Sub-division has 2 junior high and 1 high school in rural area. Kailasahar has 2 multipurpose higher secondary and 1 high school in the town and 1 high School in rural area and there are 2 multipurpose higher secondary Schools and 1
high school in Dharmanagar town area and 6 junior high and 2 high schools in the hills of the Sub-division.

The total enrolment at the secondary stage by the end of the third plan period (1965-66) was about 11,000 (7,900 boys and 3,100 girls). The multipurpose higher secondary schools provide 23 courses in humanities, 17 in science, 15 in commerce, 4 in technology and 2 in home science and 1 in fine arts.

The secondary education which serves as a bridge between primary and higher education is expected to prepare young persons between the age group 14-18 in the world of work and entry into higher education. The secondary education starts with classes 9-10 leading to higher secondary classes 11 and 12. The relevant children population at the secondary and senior secondary level, as projected in 1996-97 by NSSO has been estimated at 9.66 crores. Against this population, the enrolment figures of the 1997-98 shows that only 2.70 crores attending schools. Thus, two-third of the eligible population remains out of the school system. To accommodate the children in schools at secondary level, we have at present 1.10 lakhs institutions (1998-99). With the emphasis on universalisation of elementary education and programmes like District Primary Education Programme, the enrolment is bound to increase and once this happens, we may require more than two lakhs institutions at the secondary level to accommodate them.

2.5.2.2 Stages of School Education in India:

The secondary stage consists of classes IX-X in 19 States/UTs. Viz., Arunachal Pradesh, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Manipur, Nagaland, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Andaman & Nicobar Islands, Chandigarh, Delhi and Karaikal region of Pondicherry. The High School stage comprises classes VIII to X in 13 States/UTs viz., Andhra Pradesh, Assam, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Meghalaya, Mizoram, Orissa, Dadra & Nagar Haveli, Daman & Diu, Lakshadweep and Mahe & Yanam regions of Pondicherry. However, the higher secondary / senior secondary stage of school comprising classes XI-XII (10+2 pattern) is available in all the States/UTs though in some States/UTs these classes are attached to Universities/Colleges.
2.5.2.3 Recent reforms towards improvement of Science Education in Schools:

To improve the quality of science education and to promote scientific temper, a centrally sponsored scheme: ‘Improvement of science education in schools’ has been operational since 1987-88. Under the scheme 100% assistance is provided to the states / union territories (UTs) for provision of science kits to upper primary schools, upgradation of science laboratories and library facilities in senior / secondary schools and training of science teachers. The scheme also provides for assistance to voluntary organizations for undertaking innovative projects in the field of science education.

2.5.2.4 Innovative uses of non-school resources:

In order to promote and popularize science education, several out-of-school activities (using non-school resources) like science exhibitions, science clubs, debates, essay writing and quiz competitions are being organized by the NCERT, the Department of Science & Technology (DST), the National Council of Science Museums (NCSM), the Ministry of Non-Conventional Energy Sources (MNCES) and many voluntary organizations, such as: Vikram Sarabhai Science Centre, Ahmedabad; Homi Bhabha Centre of Science Education, Mumbai, etc.

NCERT has been pioneering exhibitions in India. It has been organizing national level science exhibitions every year since 1971. The national level science exhibition is the culmination of a series of exhibitions organized at school, district, regional and state level every year. At the beginning of the school session every year, NCERT circulates to all states/UTs the main themes and sub themes of the state-level science exhibitions for a particular year. In keeping with the central and state government’s emphasis on improvement of educational facilities in rural areas and for economically weaker sections of the society, the main theme of national and state-level science exhibitions are infused with a distinct bias towards the felt needs of rural India. The social aspect of science and relevance of science and technology for development are some other criteria, which are given due consideration in determining the themes. The NCERT also provides detailed guidelines to the states for organization of exhibitions and outlines the criteria for evaluation of exhibits and the selection of judges. The financial and academic support for
the organization of science exhibitions are mainly provided by the NCERT and the state
governments concerned. A list of exhibits selected for display at the National level with
brief synopsis about each exhibit, a book titled ‘Structure and Working of Science Models’ containing details about some selected exhibits and publicity folders about the
science exhibition are published every year by the NCERT.

The National Council of Science Museums (NCSM) organizes a number of
activities like demonstration lectures, mobile science exhibitions for rural schools, science quiz, science seminars, science fairs, Nature Study and Environment Awareness Programs. NCSM operates and contributes to science education of children at a mass
level through its four museums located at Kolkata, Bangalore, Mumbai and Delhi,
besides utilizing a number of regional centres situated in different parts of the country. NCSM has set up 301 school science centres in the states of West Bengal, Assam, Tripura, Manipur, Andhra Pradesh, Karnataka, Madhya Pradesh, Haryana, Punjab and Rajasthan. The centre develops kits and teaching aids, conducts hobby camps, popular lectures, exhibitions etc.

Vigyan Prasar (an autonomous organization under the Department of Science & Technology) has established a network of Science Clubs (VIPNET) throughout the
country to strengthen the science club movement and to co-ordinate with other existing clubs and agencies. Vigyan Prasar also contributes to learning of science through its Homepage started in September 1996. It offers daily science news pertaining exclusively to Indian science and Technology (S & T) along with archived news, links to other related sites, an online popular science magazine, com.com, which features interviews with eminent scientists, S&T development stories and articles on topical S & T themes.

Vikram Sarabhai Community Science Centre, Ahmedabad, conducts a mobile exhibition known as ‘Science Circus’. In this project, all materials required for demonstration, participatory events as well as slides, a special bus takes around films, etc. At any chosen venue, these are displayed for the benefit of the public. Most of these activities are related to the prescribe curriculum while some others demonstrate the application of science in daily life.

The National Council is organizing national Children’s Science Congress every
year for Science and Technology Communication (NCSTC). In this programme, children
in the age group of 10-17 years, take up scientific projects related to local issues. They work under the supervision of the teachers / science activities and report their findings as school/block or district level Congresses. Select projects are presented at the state and national level.

The National Bal Bhavan has been contributing towards enhancing the creativity among children in the age group of 5-16 years especially from the weaker section. It was established in 1956 and now operates throughout the country through its fifty-three affiliated state Bal Bhavans. There is a library as well as National Children’s Museum. It regularly organizes programmes wherein children can pursue activities of their choice such as in environment, astronomy, photography, science-related activities etc. These experiences are enjoyable and memorable for the children, especially as they are predominantly from disadvantaged backgrounds. Thematic and general workshops are also organized regularly for teachers, trainers and adults in science activities.
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