

CHAPTER 1

INTRODUCTION

1.1. CONTEXT OF THE STUDY

1.1.1. The Education System of Bangladesh

Bangladesh inherited an education system, the foundation of which was laid down by the British administration long before in accordance with Wood's educational dispatch of 1854. This dispatch, in fact, contributed subsequently to the creation of a network of graded schools, university and the affiliated colleges at the one end, below these come high schools and at the bottom, indigenous primary schools in British India.¹ This school system ultimately took the shape of today's modern system of education in this sub-continent.

The school education of Bengal during the British period was of ten years duration, consisting of the primary stage of four years from classes I to IV and secondary stage of six years² from classes V to X of which first two years formed the middle school stage and the remaining four years were regarded as the high school stage. As a result of partition of India, Pakistan came into being as an independent and sovereign state. Bangladesh was then a part of Pakistan.

Thus, immediately after the independence, education received high priority in Pakistan which resulted in both structural and curricular changes. As a first step, the duration of primary education was increased to five years consisting of classes I to V, according to the recommendation of East Bengal Educational System Reconstruction Committee of 1951. The duration of secondary education in the new system was made five years with classes VI to X,³ of which first three years and remaining two years were regarded as middle and high school stages respectively. Thus, a 5 + 3 + 2 system of school education came into practice in 1951 which continued upto 1960, when a radical change was brought about in education of the country in general and secondary level in particular. This time the duration of secondary education was expanded from the existing ten years to twelve years throughout the country. This structural change in the system of education was brought about in accordance with the Report of the Commission on National Education of Pakistan, 1959. The whole school education then took the shape of a 5 + 3 + 2 + 2 system consisting of the following stages.⁴

<u>The Stage of Education</u>	<u>Duration</u>	<u>Age Group</u>
1. Primary Stage	5 years	5 ⁺ to 10 ⁺
2. Middle Stage	3 years	10 ⁺ to 13 ⁺
3. High School Stage	2 Years	13 ⁺ to 15 ⁺
4. Intermediate Stage	2 years	15 ⁺ to 17 ⁺

The above changes in the structure of education was undoubtedly a significant step in the history of education in this country. Previously the intermediate stage was regarded as a part of university education and was controlled by the university. After the change in 1959, this stage began to be considered as a part of secondary education which is presently known as higher secondary and it was shifted from the jurisdiction of the university to that of the secondary education board. The other significant change in the secondary level of education in this country was the introduction of multistream courses of study in classes IX and X of high school stage. Consequently, the streams like Humanities, Science, Commerce, Home-economics etc. were offered in the high schools of this country. The objectives of introducing these specialised streams of education from the early period were to prepare the young learners in accordance with their bent for suitable avocations in future life.⁵ These multistream courses of studies were continued upto 1982, even after the emergence of independent Bangladesh.

After emancipation in 1971, the Government of Bangladesh pledged to establish a new and egalitarian social order in consonance with the national ideology and state policy which is different from that of Pakistan. So, at the dawn of independence it became imperative for the government to reform the education system first and accordingly a commission was appointed in 1972, to examine thoroughly the existing system

of education and recommend a suitable one for this new country. Meanwhile, a bold step like nationalization of primary education was taken by the Government in 1973. The Commission submitted its Report giving special emphasis on mass education, work and life oriented education, integration of religious instruction with public education system, vocational, scientific and technical education for the country. Looking upon secondary education as both terminal and preparatory for higher education in character, the commission recommended bifurcated⁶ courses of study viz., vocational stream for major part of the learners and general education stream with vocational bias for a few for the preparation of higher education in Science, Humanities and Commerce. All the recommendations of the commission were accepted by the then Government on principle. The subsequent national curriculum and syllabus committee of 1977, however, ignoring the recommendations of above mentioned commission of Bangladesh, prepared a single stream new curriculum with compulsory science in the secondary stage. Thus, the 5 + 3 + 2 + 2 system of school education which was in vogue from 1961 is still existing in the country.

The deliberations on the education system of Bangladesh are still going on. Recently it has become again a point of discussion when new education policy⁷ has been announced after taking over the political power by the government in 1982. The structure of the future education system as proposed in the

policy would remain the same as before, but the change is in nomenclature only. The new structure would be as follows:⁸

<u>Stage</u>	<u>Duration</u>	<u>Age Group</u>
1. Primary	5	5 ⁺ to 10 ⁺
2. Preparatory	3	10 ⁺ to 13 ⁺
3. Secondary	2	13 ⁺ to 15 ⁺
4. Higher Secondary	2	15 ⁺ to 17 ⁺

In the proposed policy of education, Arabic would be one of the compulsory subjects at the primary level. Provisions are also there in it to teach Sanskrit and Pali for other non-muslim children. After preparatory stage, the pupil may go to either two year, secondary education or a vocational course ranging from six months to two years. But in the higher secondary stage one can pursue two year higher secondary certificate course or a three year diploma course in various subjects.

The above education system as proposed in the new policy remains still unsettled. The educationists, the spokesmen of different political organizations and elites of the country, have expressed their views and arguments candidly in both the directions, favourable and unfavourable to the policy. Therefore, we shall have to wait to see the shape of education system of the country as it is going to emerge in the coming years.

1.1.2. Education and National Development

In recent past, national development was primarily referred to in terms of economic growth and was equated to an increase in gross national product (GNP). Furthermore, it has been also seen from experiences of different countries that increase in GNP does not necessarily result in the development of an entire nation. Therefore, other social indicators such as the reduction of unemployment, equitable distribution of wealth reducing the gap between rich and poor, status of health, nutrition and housing, etc., have been added to it as a new concept of national development.⁹

The ingredients of economic growth are, however, fairly known. Among the ingredients, are natural resources, capital, skills, know-how and the ingenuity of the people. Out of these, human resources is of highest importance.

Economic growth is dependent on the effective use of human and material resources of a nation. It is undoubtedly a very difficult task and requires harnessing all the resources of the country first. This is, generally attempted through two main programmes, namely, the development of physical and human resources.

1.1.2.1. Development of Physical Resources

The development of physical resources is generally achieved through modernisation of agriculture and rapid

industrialization. These further require application of science and technology, heavy and rapid capital formation, investment and the provision for essential infrastructure of transport, credit marketing along with other allied institutions.¹⁰

1.1.2.2. Development of Human Resources

Human resource development on the other hand means, a process of building knowledge, skills, the working ability and the innate capacity of all the people in a society.¹¹ This is of course more crucial, that is, without the development of human resources adequate development of the physical resources is not possible at all.

The main instrument of human resource development is the education of the people. In the present day world:

"No longer is education seen as merely an individual consumer good for national preparation, informed citizenship and personal cultivation. It is now also recognized as an important kind of capital investment and an instrument for national development specially in the less industrialised countries of the world".¹²

Of the many ways, formal education contributes the most. It begins with primary education and continues through its various stages. Human resources are also developed through on-the-job training programmes by the employing

institution and through self development by taking the formal and informal courses with self initiative. Human resource development further includes the improvement of health and nutrition of the working people through better medical programmes which increase the working capacity of the people.

Human resource development and the realization of a country's aspiration get reflected in the knowledge, skills, attitudes, values, etc., of the people as a whole. This change can be brought about without violent revolution only through education and education alone. Help from other agencies is required, but education is a sure and tried instrument¹³ in combating many of the problems those retard human resource development, as it can reach the people at large.

1.1.2.3. Science Education and National Development

The discipline of education today comprises⁵ many and varied fields of human inquiries and science has the major share. It is rightly said that the human progress is largely the progress of science and technology. With the above assumption in mind, let us now have a close look at the views of the people in respect of the contributions of science and technology to the national development.

In the Commonwealth conference of science education held in Cylone in 1963, it has been pointed out that several

countries have been able to increase their GNP very rapidly through industrialization in its broadest sense of manufacture, agriculture, transport and communication, distribution, etc., which are the strengths of modern economy and industrial progress, as we know, depend upon science and technology. This is possible only with the help of a rapidly increased supply of skilled and semiskilled workers, technicians, engineers, physicians, technologists and scientists to boost the process. A strong base of science education is, therefore, becomes indispensable to all nations aspiring for economic development.

While describing the implications of education in science and technology (for) national development, Baez¹⁴, a Unesco expert, pointed out that it has positive correlation with economic and social development of a country. Firstly, scientists and technologists contribute greatly to the building up of the economic infrastructure of a country, no matter how unsophisticated it may be. Agriculture, industry, housing and health are closely associated with them on which well-being of the country rests so heavily, and for their development are needed personnel with scientific and technological knowledge and training. Secondly, and possibly the more important than the first is that, science, if properly integrated with educational programme, can infuse the whole educational process with confident and competent approach to solve problems of life and society.

It has been recognized by the leaders¹⁵ of the developing countries that science and technology could play an important role in development. It is a powerful dispeller of fear and superstition, fatalism and passive resignation.¹⁶

While drawing up educational policy implication for economic development of Asian countries, it has been clearly enunciated:

A high level of economic development can only be achieved, if qualified scientific and technical personnel are produced in the required number to satisfy the man-power need of the country.¹⁷

The tremendous economic growth and better living of the people of the advanced countries are basically due to their emphasis on science and technology. The U.S.S.R.'s economic growth over the recent decades is due to its application of science directly to the production. Science has a greater role in the Soviet Union than any where else in the world, which is evidenced by its rapidly increasing number of scientific workers. Between 1940 and 1960 alone it rose from 98,000 to 3,54,000 representing an increase of 360 percent. In the next 20 years, if the same rate of growth persists, it may rise to millions.¹⁸

The instance of West European Countries and America hardly need any mention. These countries have shown advancement in scientific thinking through the centuries. Great

scientists like Francis Bacon, Robert Boyle and Issac Newton to mention only a few, have contributed enormously to the shaping of human destiny. The invention of steam engine which in turn resulted in the industrial revolution, is largely the culmination of great scientific invention made by these great scientists. This has brought about a great change in social, economic and political aspects of life. The development was further carried over by the works of Max Plank, Albert Einstein and others and this has ushered the present nuclear age.¹⁹

Practical knowledge as we call it today, is the gift of science. Man, throughout the ages, has been using this weapon to cope with nature and to overcome his physical limitations. Science helps us to use and explore minerals and other resources of the earth and sea, to improve agriculture and industry and to fight diseases of the body. Technology represents the application of science and boosts up the utilization of natural resources and production. So it can be undoubtedly said that science and technology are at the core of national development activities anywhere in the world.

Bangladesh, like many other third world countries, has a long colonial past. Two hundred years subjugation and exploitation by the colonial rulers crippled every sphere of national life of this country. The partition of this subcontinent in 1947 created India and Pakistan as two independent states. Bangladesh, then East Pakistan, suffered

still another setback as it fell victim again to the exploiters of Pakistani regime. It was a tragic tale of exploitation for almost 25 years. Further, the war of liberation against the Pakistani military junta in 1971 shattered the economy of this region to a great extent. It is unfortunate that the country has recently been listed among the poorer nations of the world. The vast fertile land, jute and natural gas have remained untapped properly in the past; their proper and timely exploitation could have brought a far reaching economic and social change in the country.

With the emergence of Bangladesh as an independent nation increasing attention has been paid to the maximum utilization of its resources by developing agriculture and industry aiming at economic growth and prosperity of the nation.

It is now admitted that development of the agriculture sector alone can go a long way to solve most of the economic and health problems of many of the Asian Countries. Agriculture is the source of sustenance for 90 percent of the people of Bangladesh and will continue to be the most important socio-economic activity in the next few decades. The recent discovery and use of high yielding and early-maturing varieties of food crops have hightened the prospects of developing agriculture as a modern and viable sector of

economy.²⁰ Furthermore, the use of fertilizer and pesticides and the expansion of irrigation facilities added a new dimension to the opportunities of agriculture. This technological advance urgently calls for a vast number of skilled hands in farming. The situation also demands new experimentation and research for effective use of new technology and innovations.

As for the industrial sector, the country is not lagging behind. It is also assuming increasingly dynamic role in the economic growth, jute being the largest potential agrobased industry of Bangladesh. But it has so far been limited to the production of traditional goods. Research and innovation in jute industry can open up new economic possibilities for this industry. Natural gas, though a boon to the country in this days of fuel crises, is only being used as fuel and manufacturing fertilizer. The gas too can very fruitfully be used in the development of other chemical industry in the country. Other mineral resources are yet to be tapped.

All these sectors and many others require a strong base of huge skilled manpower supply for the economic growth in Bangladesh. A science-oriented education system only can go a long way to make up the requirements for skilled manpower.

Considering the role of education in general and science education in particular for national development, the Government of Bangladesh has taken keen interest in reforming the existing system of education in order to fit it best to the national development enterprises in the country.

The present curriculum and syllabuses from grade I to grade X have been introduced all over the country and have special emphasis on science education. The basic objectives of this curriculum have been derived from the national education policy for providing meaningful education to the learners. The principal ideas in this regard are to make the learner keenly observant of the resources around him in the environment and develop scientific outlook in order to enable him to take correct decision, regarding various problems of everyday life.

Of the school level, secondary education is, no doubt, very crucial. It is both terminal and preparatory stage of education. It is terminal for a vast majority of learners who leave school to join the labour market and preparatory for a few who aspire to go up the ladder of education. Secondary education produces most of the skilled and semi-skilled manpower required in the various development sectors of the country. On one hand and on the other, it is the stage of education where the basic science is taught for building the foundation of the career of future engineers, technologists, scientists

and doctors. Harbison and Myers²¹ also prescribe the reform and expansion of secondary education placing stress on teaching fundamentals of science and mathematics for developing countries to build the base for industrialization and agricultural expansion.

Therefore, science education has become a major concern in Bangladesh on the ground that it may contribute 60 percent efforts²² in any development work. Hence, high priority is being accorded to its expansion and qualitative improvement and for this purpose higher financial allocations are being earmarked in the national budgets and also in the five year plans with the belief that the investment would yield dividends in terms of development.

1.1.3 The Growth of Science Education in the School Level in Bangladesh

The education system that had been implanted by the alien government before 1947, was obviously determined by the socio-economic, political and cultural conditions existing in a colonial society. During the foreign thral the country witnessed quite a good number of educational commissions and committees with their recommendations and suggestions which had very limited scope for the development of education in this land. The rulers, however, deliberately refrained from giving a system of education which is progressive and relevant

to the time and need of the society, quite obviously for their colonial interest:

The system of education prevalent in Bangladesh as elsewhere in the subcontinent during British period, developed on deeply entrenched colonial roots. The colonial rulers were mainly concerned with revenue and administration which could be manned by person educated in liberal arts.²³

Hence, at the time of independence in 1947 the country inherited an education system which was narrow, unrealistic and unable to cater to the needs of the changing situation caused by emancipation. It had an undue academic bias and science was totally absent from the curriculum of secondary school. So, soon after independence of Pakistan the teaching of science as a separate subject of primary school curriculum in the East Bengal (Present Bangladesh) was first introduced in accordance with the prescription of the East Bengal Education System Reconstruction Committee (EBESRC) of 1951. Nature study and object-lesson were however, in vogue in the primary and middle school stage in Bengal before 1951.²⁴ But science was neither recognized as a separate subject for primary school nor was there any separate textbook for science. Science lessons were then included in the vernacular readers of the children.²⁵ So it may be said that the year 1952 may be taken as the year of the beginning of the organization of systematic teaching of science in the primary schools of Bangladesh. During the twentytwo years period between 1952 and 1984 the curriculum

of science at primary level underwent changes thrice, once in 1952 and then in 1960 and 1977.

It has been pointed out above that science teaching in the name of nature study and object-lesson was also in vogue in the middle school stage (classes V-VI) before 1947. The EBESRC of 1951, emphasised the need of teaching nature study in class VI and general science in classes VII and VIII. But it did not prescribe any definite courses of study of science for these classes. From the content of middle school science course it is found that it was confined to teach personal hygiene, health care, cleanliness, nursing of patient and also some elementary science.²⁶

The status of science education in the high school stage in East Bengal (present Bangladesh) was different. The whole secondary school was at that time under the domination of matriculation examination requirement of the Calcutta University till 1947. An elementary science course was, first introduced as an optional subject of Matric course by the regulation of Calcutta University in 1935. This subject was to be regarded as a compulsory subject after five years from the date on which the first examination was held. But this regulation of introducing elementary science was not implemented till 1947 and even after independence of Pakistan too. The same elementary science course began to continue as an optional subject of matriculation examination up to 1951. An

'elementary scientific knowledge' was, however, offered as an additional optional subject in 1951 in the high schools of East Bengal (Bangladesh) which only replaced the 'elementary science course introduced by the Calcutta University in 1935 and it continued upto 1961. The content of the course consisted of the following topics:²⁷

1. The earth, its history, its ever changing face.
2. Energy, the agent of all changes (coal, oil, wind and water power).
3. Motion, change involving force and matter.
4. The molecular nature of matter.
5. Chemical changes and atomic constituent of matter.
6. Electricity at rest and motion. Electricity and matter.
7. The chemical reaction, the reaction of ion in solution.
8. Atomic structure and chemical behaviour.
9. Carbon.
10. Nitrogen.
11. Waves as carrier of energy, sound, light, radio, ultra-violet light, X-ray, radioactivity.
12. Atomic energy, its use in war and in peace.
13. The earth and heavenly bodies; the earth, the Sun, the planets, stars and the Universe.
14. Life, the living cell, the human body, classes of animals, plants and bacteria - evolution.

A radical change, for the first time in the history of education in this country took place following the recommendations of Commission on National Education of Pakistan,

1959. From this time, the situation took a big turn in favour of science which got an important place in the school curriculum. As a result of this change general science became a compulsory subject in the secondary level of education in this country from classes VI - X. Furthermore, provisions were also made to introduce diversified courses in various streams of which science was a very important one. These diversified courses were offered after eight years of schooling, that means, in classes IX and X. The students opting for science stream had to take the courses in physics, chemistry, biology and advanced mathematics. On the other hand, the students opting for other streams like humanities, commerce, agriculture, etc., were required to take general science as a compulsory subject. These steps in favour of science education were taken with the belief that science has a great role to play in a free society for the preparation of the citizens. The major objectives of education was to develop the people of the country as an individual, as a citizen and worker.²⁸

The content of the science courses, of course, were a sort of modification and adoption of the pattern pursued in the western schools. Indegenous problems and their solution by the application of scientific knowledge had a very little place in it. It provided little opportunity to the learner to have the ideas of the natural resources of the country and the techniques of harnessing them for the well-being of the nation.

With the emergence of Bangladesh, as an independent and sovereign country, the political power of the state, for the first time in the history of this land, came into the hands of its people. The Government of Bangladesh realized that the country was beset with a lot of problems like poverty, unemployment, illiteracy and a stagnant economy which was further shattered by the nine months' bloody war of liberation. The country, any way, has many potential resources. The fertile land, huge deposit of natural gas, jute, etc., are some of the few which have been already mentioned. The possibility of other mineral resources are there in the country. But they are still untapped. So, immediately after liberation, the first and foremost task of the government was to initiate national reconstruction activity throughout the country with an all out effort to reinvigorate its war-ravaged economy by mobilising its resources. This is not an easy task and requires huge number of skilled and semi-skilled man power in every field. A steady supply of such manpower is only possible through the educational pipelines. Therefore, reform of the existing system of education was indispensable at that moment to make it fit for the immediate national needs. The government had put highest priority to education for its reform and modernization in the post liberation period. Accordingly, in the new system, study of science has been given great importance than ever in the entire school stage. Efforts have been made in the new curriculum to correlate education in

science, and technology with learner's environment so as to make it as a tool for solving the life problems and at the same time to avoid bookish science education. At the primary stage science has been treated as a part of environmental studies rather than as a separate subject. The contents of the curriculum of primary science have been developed and organized in such a fashion that the learner may be acquainted with his immediate environment, specially the elements of the environment which lead him to understand and appreciate his basic needs like food, clothing, shelter, cure from disease and the climate, inanimate objects of the environment, animals, birds, social environments, cleanliness and hygiene and light, heat etc.

The content of science in the lower secondary stage (Classes VI-VIII) includes the components of natural science like physics, chemistry, biology and geography as well as health and population education and have been incorporated in the framework of general science basing the knowledge and experiences gained in the primary stage.

In the secondary science curriculum, on the other hand, elements of various branches of science have been organized into two papers under the title of 'Physical Science' and 'Biological Science'. The first paper includes physics and chemistry while the second paper includes the elements of botany, zoology, hygiene, nutrition, application of biological science, population education, conservation of the environment

and natural resources.²⁹ In the Secondary School Certificate Examination both the papers are compulsory for all the students opting for it.

It is expected that these science courses will help the learners to know the environment and its problems intimately so that they will be prepared with positive attitude, skills and competencies to solve their life problems that is by using the tools, techniques and methods of science in home, farm, factory on the one hand and on the other, they will lay the foundation of preparing themselves as the country's future scientists, technologists, engineers and doctors.

1.1.4. Policy and Priority of Science Education

Science, by virtue of its efficiency today, opens up huge field of human action. It has penetrated into the corridors of power in three forms, namely, economic, political and military. The supremacy in science is being looked upon perhaps, as never before, as a sure way of insuring the supremacy in economic, political and military field. This is quite evident from the scenario of advanced countries of the world. Most of the advanced countries, particularly the U.S.A. and the U.S.S.R., are controlling the whole world economically, politically and militarily by dint of their supremacy in science and technology. Their supremacy in science and technology is due to their highest number of scientific personnel they have. About 86 percent of the

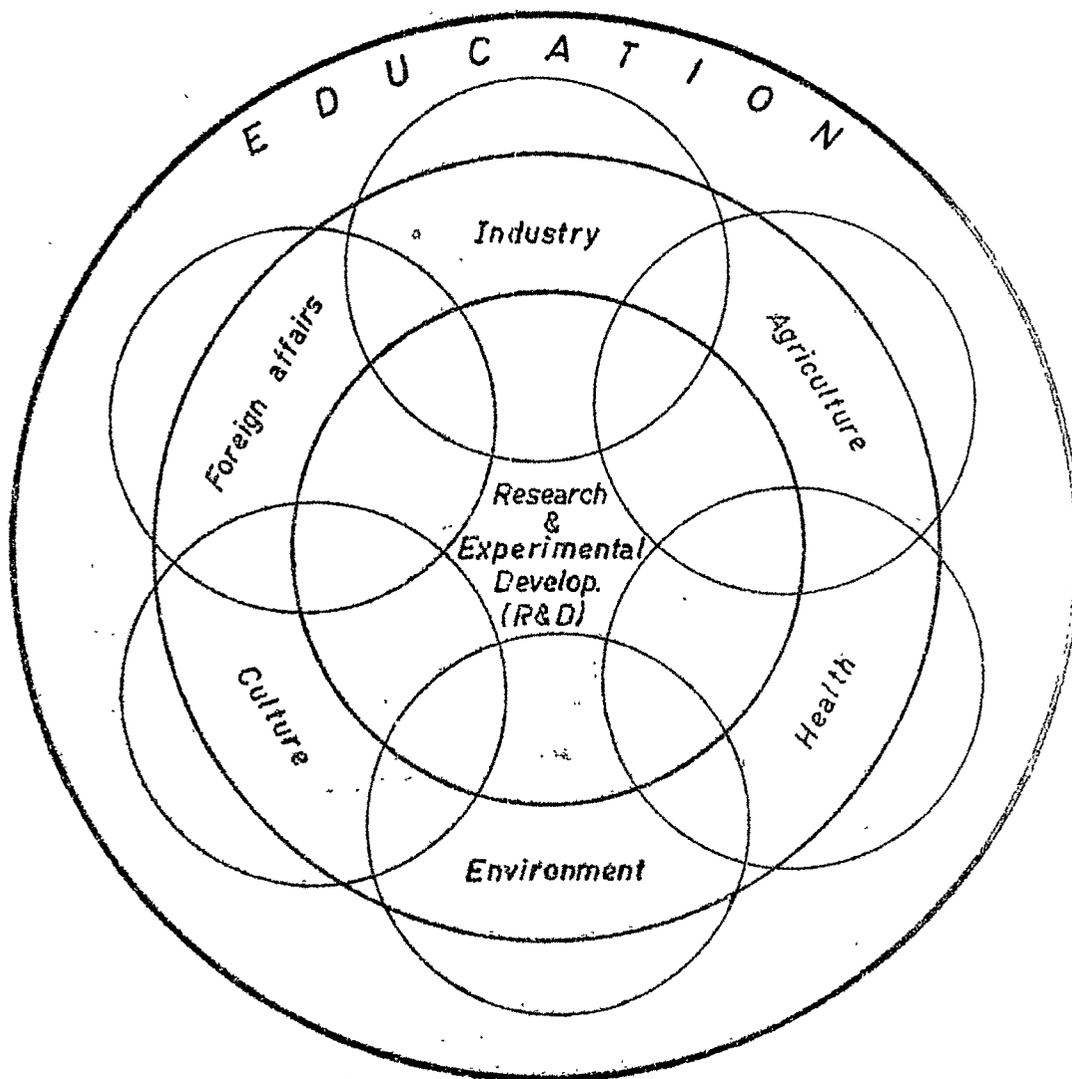
total number of scientists and engineers working in the world are concentrated in the zone of advanced countries. This zone is inhabited by only 30 percent of the population of the world. Out of the 86 percent the joint share of U.S.A. and U.S.S.R. is 58 percent.³⁰ So, from the above figures, it can be perceived easily, to what extent they lay importance to the science education in creating such a situation in the present day world.

The situation in developing countries on the other hand is quite different. The scientific and technological efforts of these countries are mainly directed to their survival and economic growth and better life of their people, which the developed countries have achieved long before. The economic growth is, of course, the primary objective of almost all the countries. To bring about economic growth in a country requires rapid industrialization and agricultural revolution. Industrialization in modern sense is the offspring of science and technology. It involves machines and technical know-how. The agricultural development too involves soil, water, climate, seed, fertilizer, insecticide and many other things. Soil analysis again involves physical and chemical aspects of science, itself. For the development of water resources, it is necessary to find the essential facts about climate, hydrology, soil and geology. The other agricultural inputs are very much dependent on the understanding and development of science and technology. Both industrialization

and agricultural development in a country are possible, only when it has an abundant number of personnel with scientific orientation. The supply of such personnel generally emerges out of the education system. Therefore, a science oriented education system is a must for economic growth in a country. It not only supplies the required manpower, it also produces research personnel, who generate new knowledge and technology in tapping the as yet unknown and unexploited wealth. So to create a band of scientists, technologists and engineers and a broadening stream of people with the background of science, needs an effective policy of science education, which is a part of the broader policy of education leading to coherent development plans. The policy of science education may be defined as the sum of accepted principles and methods, legislative and executive measures taken to stimulate, modify, organize and use the scientific and technological potential with the object of meeting a country's competitive challenges and achieving its overall development goals; economic, social and cultural.³¹ In operational terms, science policy is the business of the politicians, managers, and specialists in the field of science and technology who are dealing with institutions and processes that determine what is to be researched, what for, by whom, under what circumstances, and at last but not least, what is to be done with the results. Whereas 'science and technology' are centred in the laboratories and workshops, the 'policy making' is centred in the

committee rooms and cabinet meetings. The creation of condition conducive to a steady and balanced development of science and to its judicious use for economic and social development of a nation, is the basic reason which lead the state to define and apply a national science and technology policy. A nation, unless it has an adequate scientific and technological potential arising from a well-conducted and persistent policy for science, cannot reach the point where it can usefully apply a science policy.³² Science policy is again closely related to other aspects of national life, like industry, agriculture, health, environment, culture and foreign affairs in which education is common. Broadly speaking, science policy is concerned with education, the stock of knowledge, its availability and use and research and development. Carter and Williams³³ emphasised on education for its pivotal role in a country's development policy because the supply of people capable of using science, and of adding to it by research depends on education. Likewise, the supply of people capable of using technology and of adding to it by design and development work depends on education. Research and development grow out of education, development grows out of research, innovation grows out of development. Science policy and its principal interconnections with other aspects of national life may be put diagrammatically and is shown in the next page.

SCIENCE POLICY AND ITS PRINCIPAL INTERCONNECTIONS WITH
OTHER ASPECTS OF NATIONAL LIFE



Ref. Science and Technology in African Development:
Science Policy Studies and Documents, No. 37,
Paris, UNESCO, 1974, p-80.

Thus, science and technology policy is in fact, an integral part of overall national policy - that part which consists in improving the resources available to science in promoting technological innovations to attain national goals.

Bangladesh was under foreign subjugation for a very long period and the rulers were mainly concerned with revenue and exploitation of its resources for their own interest and did very little for its development. The first efforts in respect of the introduction of science education in the school stage was made soon after independence of Pakistan, 1947. This effort was, in fact, limited to primary level of education in the country. In 1961 the situation, of course, tilted a little further in favour of science which gained more important place in the curriculum according to the new education policy of the then government. The upshot of this policy was the introduction of science in the secondary level of education (from classes VI to X) as a compulsory subject. Two types of science courses were then offered in classes IX and X, one at the ordinary level and other at the advanced level for pupils opting to science stream.³⁴

A decade after the education reform in 1961, the government declared its new policy regarding education. The main feature in respect of science education is quite remarkable particularly in the secondary level. Looking upon secondary education as a terminal stage for the vast majority of learners

and a preparatory stage for higher education of a few, it had been emphasised in the policy that the curricula should cater to these dual needs of the pupil at this stage. Further, in view of the increasing demand for mid-level skilled workers in the developing economy the stress of secondary education had been shifted to science, technology and vocational education. A target of enrolment ratio 40:60 between general stream on one hand and science, technical and vocational streams on the other, was proposed in the policy. Establishment of a centre of excellence in science education in each administrative sub-division and production of science equipments in the country were other outstanding features of the proposed policy for the promotion of science education.³⁵ The implementation of the proposals of the above education policy had not been possible due to the political crises of 1971 in the country which ultimately turned to an armed struggle between the people of the then East Pakistan (present Bangladesh) and West Pakistani military Junta (present Pakistan) resulting in the creation of an independent and sovereign Bangladesh.

The Government of Bangladesh accepted the views underlying the report of the first national curriculum and syllabus committee of 1977 as its policy, where it has been mentioned that poverty and unemployment have become common problems in the country for historical reasons. The future prosperity and well-being of the nation depend on the solution

of these fundamental problems. But it is only possible through the wide application of science and technology. Hence, science and technology have been given an important place in the new school curriculum and syllabuses.³⁶ Accordingly, science has been made a compulsory subject in the entire level of secondary education in Bangladesh, since this stage of education builds the foundation of future scientists, technologists and engineers who subsequently take part in the national development activity of the country. In the first five-year national development plan, (1973-78) high priority had been accorded to education and 5 percent of the total expenditure of the plan was committed to education sector. The important targets set there to achieve in respect of science education were:

1. Science education should be strengthened in both colleges and schools;
2. Establishment of central laboratories and community workshops in the urban and rural areas to cater to the needs of science education with the idea that the students in the schools around the centre would use those laboratories and workshops for learning science.³⁷

Out of the two targets mentioned above, the second one had never materialised in the country. Bangladesh Government later, formulated its science policy³⁸ and it was published on July 1, 1980. Very recently, the government, however, instructed its National Council of Science and Technology (NCST)

to review and restructure the National Science and Technology (NST) policy. The new science and Technology policy is expected to be made public by the government very soon. The new policy will undoubtedly help to create a condition favourable to the development of science and technology in the country to a great extent.

The main features of the outgoing policy of science and technology of 1980 were as follows:

1. The policy provided a National Council of Science and Technology with the President of the country as its Chairman. This council was responsible for the formulation, implementation and coordination of the scientific and technological research and development activities in the country. The work of planning, budgeting, coordination, promotion and execution and proper evaluation of scientific and technological activities were also shouldered on this council.
2. It has been mentioned in clause 8 and 15 of the policy, that the educational institutions will carry out the pursuits of science and technology through effective curriculum.

Bangladesh is now in the process of establishing a new social and economic order in the country. As it has been recognized that the contribution of science and technology

is over 60 percent in any developmental work and as the inherent strengths of a nation in the present day world lies in the scientific and technological knowledge and skills of its people, science and technology have been given topmost importance to their cultivation through a concrete policy of the government. The effect of this endeavour could be seen not right now but in the years to come, since the country is in the preparatory stage of development.

1.1.5. A Glimpse into the Present Science Curriculum in Bangladesh

The curriculum consists of experiences, the learner has under the direction of the schools. It shows, by what kind of educational activities the teacher will fulfil the requirements of the syllabus. It includes any material and activity that affect learning, development, attitude or behaviour of the learner. The syllabus prescribes the content of teaching to be given and curriculum prescribes the methods to be used. The curriculum is primarily concerned with methods and therefore, with education. It is made up of pedagogical directives and intends to provide assistance, advice, suggestion and information to the teacher in carrying out his work successfully. The present science curriculum of Bangladesh was prepared by a number of subject committees in 1977 following the proposals, suggestions and recommendations of education commission of 1974. The tasks of the construction of curriculum

were limited to only framing the syllabus and preparing guidelines for the teachers for its implementation. A brief outline of the existing science curriculum and syllabus of the secondary stage of education of Bangladesh has been furnished here:

1.1.5.1. The General Objectives of Science Education

The general objectives of science education as a whole up to the secondary level as envisaged in the new curriculum are:

- to develop interest and curiosity about the natural phenomenon and environment;
- to develop skills of observation through the study of the natural environment around the student;
- to develop the ability for using scientific method of work;
- to develop ability to think logically;
- to help the student to improve his quality of life and those around him through useful conservation of natural resources;
- to provide the student with scientific knowledge and skills to solve problems of daily life;
- to link science education to productivity;

- to help develop certain vocational productive skills so that the school-leavers can keep themselves gainfully occupied by self-employment or such other avenues;
- to develop in learner a system of values related to their personal, social and cultural lives.

1.1.5.2. The Content of the Syllabus

The five years secondary education from classes VI to X of Bangladesh consists of two phases, namely, lower secondary from classes VI to VIII and secondary classes IX and X. Therefore, the content of science of entire secondary stage has been organized separately for these two phases. As the duration of lower secondary stage is for three years, the content of it has again been organized separately for each of one year duration. On the other hand, the content of secondary level consisting classes IX and X have been organized together. The main topics of science syllabus of both levels are preceded by the specific objectives of its teaching and succeeded by the guidelines of using teaching aids and methods, evaluation procedures, preparing textbooks and teacher's guides, etc.

1.1.5.2.1. Science Content in the Lower Secondary Stage

Units and measurement, matter, air, solvent, solute, solution, magnet, electricity, light, soil, living being,

plants, human body, food, nutrition, and health, metal and nonmetals, elementary gases, heat and energy; fluid pressure, latitude and longitude, germs, first aids, chemical symbol, and formula, acid, base, salt, water, the earth, climate and weather, common diseases.

1.1.5.2.2. Science Content in the Secondary Stage

Part - I (Physical Science) : Contribution of science to the society and civilization; lives of some eminent scientists; force and properties of matter, heat, light, sound, magnet, electricity, structure of atoms, symbol, chemical formula and equation, water, electrolysis and its application, constituent elements of air, carbon, introduction of some chemical industries.

Part - II (Biological Science) : Physiographical formation of living being; fundamental difference of living being; difference of plants, biotic process of plants; toad, human body; regional variations of animal and plant; horticulture and crops; plants and crops conservation; livestock, fisheries, an ideal pond for fish culture, sericulture, nutrition and food, population, health and environment, natural resources.

1.1.5.3 Teaching Aids

A detailed list of teaching aids has been given in the report of curriculum and syllabus against each item of

the content to be used in the classroom teaching. It has been emphasised there to improvise the teaching aids if they are not available in the school by using inexpensive local materials.

1.1.5.4. Teaching Methods

There is a mention in the curriculum, the methods to be used in teaching the content of science clearly with the detailed procedure of their use.

1.1.5.5. Evaluation Procedure

It has been suggested in the curriculum that the existing examination-based evaluation has to be replaced and reorganized into a system of daily, monthly and annual evaluation regularly. The results of written, oral and practical examinations and the participation of the students to the activities like work experience, excursion, observation, science club, seminar, etc., and their involvement in scientific hobby, project work and specimen collection, etc., have to be recorded on cumulative basis.

1.1.5.6. Preparation of Science Textbooks and Teachers' Guides

A guideline has been given in the curriculum regarding the principles of preparing textbooks and teachers' guides relating to the selection of writers, language style, spelling, glossary, getup, printing and the size of the textbooks.

1.1.5.7. Suggestions for the Implementation of New Syllabus

The curriculum contains quite a good number of important suggestions in respect of the number of periods for theory and practical classes, qualifications of science teachers and organization of extramural activities in science for the implementation of the new science syllabus. Further, the distribution of marks for theory, practical and oral examination has also been mentioned there for secondary stage, that means for classes IX and X.

The science curriculum and syllabus of the past was a sort of 'adoption' and 'adaptation' of the curriculum designed in the developed countries during Pakistani period. Indigenous problems and their solution had received little importance. The efforts later, undoubtedly, paved the way for the development of science education in this region. The curriculum planners of Bangladesh, took care to incorporate indigenous problems in the new curriculum of 1977. It has also been emphasised to utilize the local resources and natural environment of the students to provide them first hand experience in science.

1.2. RATIONALE OF THE STUDY

Most of the third world countries achieved emancipation within one or two decades after the second world war. All most all of these countries before their independence were under

colonial rule for quite a long period. The aim of such colonial rule was to exploit the resources and the people of those countries and to perpetuate their rule there for unobstructed exploitation. The inhabitants of these colonies were generally denied all sorts of human rights. The rulers paid very little attention to the improvement of the lot of the people of the colony during their rule. They spared no pains to make those countries crippled in all walks of life. Their deliberate neglect towards the welfare of the colony flung them gradually to the abyss of poverty, ill-health, illiteracy and other social crises. Therefore, soon after their political independence, these countries began to look upon education as an important kind of investment for nations' future and as an instrument for national development. Since the level of income of a country is related to the level of education, those nations which have high level of education also have relatively high level of national income. Recent analysis, has however, suggested that education may be a significant factor in producing higher levels of income.³⁹

The newly independent nations, therefore, gave keen attentions to the reform and development of their education with emphasis on science education. Science education, in fact, has a strategic role in the process of adapting education to the needs of rapid social and economic change. Nehru envisioned the importance of science for the development of his country. His voice regarding the role of science for the betterment of the people of India in every sphere of life was also true

in the case of other third world countries. He stated rightly that:

It is science alone that can solve the problem of hunger and poverty, of insanitation and illiteracy, of superstition and deadening customs and tradition, of vast resources running to waste, of a rich country inhabited by starving people. Who indeed can afford to ignore science today. At every turn we have to seek its aid. The future belongs to science and to those who make friends with science.⁴⁰

It has further, been recognized that it is the application of science and technology that has made it possible for the advanced countries of the world to banish poverty and provide high standard of living.⁴¹ In the developing countries, according to Harbison⁴² the economic imperative is to build a base for industrialization while expanding agricultural production. But science and technology is the backbone of industry and agriculture, and research and development are their core processes. Both industrialization and agricultural development require a huge number of manpower at every level: research workers, engineers, technologists, technicians and manual workers. There was an acute shortage of all categories of technical and professional personnel⁴³ in the developing countries. Hence, most of the developing countries were giving high priority to science education and scarce resources were also being committed to it with the belief that this investment would yield dividends to the national development programmes of the countries.

Secondly, the launching of sputnik to the space by the U.S.S.R. in 1957 surprised the whole world specially the U.S.A. The U.S.A.'s long domination in the field of science and technology received a jolt at this startling achievement of the U.S.S.R. The U.S.A. was much anxious seeing the U.S.S.R.'s high advancement in scientific and technological field lest she should emerge out as a unique world power in future, since the sputnik had great potentiality for being used for the military purpose. The reason of the U.S.A.'s scientific and technological defeat so to say, to the U.S.S.R. was not far to seek. It was believed that this defeat was due to the U.S.A.'s existing science education system. So the U.S.A. at once came forward with its all out efforts to reform and recast the science education of the country to make it relevant to the time. Subsequently hundreds of agencies undertook science curriculum development projects throughout U.S.A. 'Harvard Physics Project', 'Biological Science Curriculum Study of the University of Colorado', 'the Earth Science Curriculum Project of American Geographical Institute', 'Minnesota Mathematics and Science Teaching Project', etc., were only some of the more important programmes that could be mentioned. Other developed countries of the free world were not lagging behind in this regard. A new curriculum development movement in science which was started in the U.S.A. and other countries like U.K., France and Japan after 1957, gathered momentum, made international impact and acquired the

status of revolution in science teaching. The surge of such movement also touched the boundary of the third world countries and it helped in creating further awareness among them towards early sixties. Because of these two reasons 'the decades of the fifties and sixties witnessed an unparalleled growth in the development of new curricula in the area of natural science'⁴⁴ in both the developed and the developing countries of the world. The developing countries while reforming their education, began to give importance to science in the school level. The aim of such stress on science education was to make a base for producing scientists, engineers, physicians, technologists and other mid and lower level technicians there, who subsequently could take part in the national development activities.

The facts briefed in the foregoing section were the impulse for introducing science education in Bangladesh (previously East Pakistan) and these subsequently led to make science compulsory in the primary stage first in 1952. The year 1961, further witnessed a significant change in the area of education in general and science education in particular, when general science became a compulsory subject in the curriculum of secondary stage, excepting for those who were opting for special science course in classes IX and X.

In the independent Bangladesh, the reform of education was felt an urgent necessity. The education system that the country inherited at the time of independence was introduced

about ten years back during Pakistani period. Consequently, its modernization was a must to keep pace with the contemporary world.

The Government of Bangladesh in response to this necessity brought about a reform in the curriculum and syllabus of the school education in 1977. Consequent upon this reform, science has become a compulsory subject in the entire school curriculum of the country. Thus, education in science gradually moved from the wings to the centre of the educational stage in Bangladesh.

At the time of preparing the science syllabus for secondary schools, both the curriculum and syllabus Committees of 1961 and 1977 clearly put a set of conditions there, to be fulfilled by the schools as priorities in creating a favourable environment of teaching science. These conditions were chiefly concerned with, facilities of science teaching, quality of science teachers, time allotment, practical works, etc. These are definitely important for science education. But during the long 20 years period from 1961 to 1981, no initiative has been taken to assess the status of science education in this country.

The data of such assessments are very much important for the improvement of the quality of science education and adopting new strategies to make up the lee way to this end. Survey helps to expedite the achievements of the objectives

by presenting to the administration a general vista of the way to be covered in this direction. And with the result of such survey before them, the policy makers can proceed with greater clarity and specificity in designing action plans.⁴⁵ Mere change in the curriculum and syllabus for the sake of modernization and their revision to make it up-to-date, is not enough to achieve the desired goal of science education in the country. With it, development of an effective instructional programme under the purview of the curriculum is equally important in each secondary school. Otherwise, all the curriculum reform efforts will go in vain and result into a futile exercise of the experts. Periodical revision and reform of science curriculum and syllabus must be carried out to make it fit for the contemporary world and at the same time all possible measures have also to be taken to develop the resources of the schools for their proper implementation. The resources for the science education programme of the schools, however, include science teachers, physical facilities, equipments, apparatuses, chemicals, teaching aids along with teaching method and evaluation procedure. The quality of science education depends on the adequacy of these resources. Now the question is, to what extent the resources for the science education programme of the high schools of Bangladesh are existing and available. The question is of vital importance in respect of the effectiveness and quality of science education in the country.

Therefore, a thorough enquiry about the status of science education programme in the high schools of the country is needed to give answer to the above question. The present study is an humble attempt to seek answers to the following questions pertaining to the status of science education programme in the high schools of Bangladesh:

1. To what extent the high schools of Bangladesh have adequate science teaching resources?
2. What are the characteristics of science teachers working in the high schools of the country?
3. How are the science teachers teaching science?
4. How are the outcomes of science teaching evaluated?
5. What are the problems of science teaching in the schools?
6. How are the practices of science education going on in the schools?
7. How is the attitude of students towards science developing with the achievements in science?

1.3. STATEMENT OF THE PROBLEM

The title of the present study is "A STUDY OF SCIENCE EDUCATION PROGRAMME IN THE SECONDARY SCHOOLS OF BANGLADESH".

1.4. DEFINITION OF IMPORTANT TERMS

- i) Secondary School : The term secondary school stands here to mean those schools which impart five years of schooling after primary education, that is, from 6th to 10th standard in Bangladesh.
- ii) Science Education Programme : Science as a discipline of human enquiry and study is quite different from other disciplines. This difference is of course, due to its inherent nature. The nature of the discipline of science is that, it is both a product and process. The product of science means what the scientists know. It is basically knowledge including facts, figures, formulas, principles, laws and theories. The process, on the other hand means, what scientists do and it refers to scientific method. The training in the process of science develops a pattern of thinking which is called scientific attitudes. Hence, in brief science is an attitude of mind, a method of study and investigation and a body of organized knowledge about the natural phenomena.

The mastery over the knowledge of science and the training in the process is the ultimate goal of science education. Therefore, in developing an instructional programme of science these two aspects must be given highest consideration so that the learner gets enough opportunity to

exercise both the aspects of science equally. The science education programme, is however, a very wide term and involves aims and objectives of science education, curriculum and syllabus, teaching facilities, textbooks, science teachers and many others. The experts of science education have given an outline about the framework of science education programme basing on their own views, experiences and thinking.

Blackwood⁴⁶ while describing the characteristics of a science education programme indicated its five components, viz., (i) purpose of science education (ii) curriculum to support the purpose, (iii) the equipments, supplies, facilities, etc., (iv) personnel of science teaching and (v) the methods of science teaching.

Ullah⁴⁷ indicated five components of a science education programme and these are: (i) national science education policy, (ii) science curriculum and syllabus, (iii) teaching aids and methods, (iv) science teachers and (v) a good teaching-learning environment in school. Stotler⁴⁸ and others pointed out that the resources of an effective science education programme are (i) teachers (ii) instructional materials and (iii) learning appraisal or evaluation.

All the ideas of the experts regarding the science education programme as depicted above may be put succinctly in the following ways:

- 1) The clear-cut aims and objectives of science education;
- 2) The curriculum and syllabus to achieve the aims and objectives, and
- 3) The resources of science teaching for the implementation of the curriculum and syllabus.

The aims and objectives vary from country to country according to the national needs and aspirations and they depend on the state policy of the country. Curriculum refers to the total experiences of the learner under the supervision of the schools. Syllabus is a part of curriculum and contains the topics of science to be taught. Curriculum and syllabus are framed in accordance with the aims and objectives of science education of a country or a society. The teaching resources are of two kinds, namely, the physical and personnel. The physical resources include science laboratory, equipments, chemicals, teaching aids, library services, finance and many other materials. Whereas, the personnel resources are mainly, science teachers and supervisors. Effectiveness of science education depends on the adequacy of physical and personnel resources.

The ministry of education of the Government of the People's Republic of Bangladesh is the highest authority responsible for planning and developing science education at the first and second level of education. The ministry plays

its role in policy making and coordinating the planning activities. The curriculum and syllabus are framed entirely by a body set up by the government. This body formulates the aims and objectives of science education in accordance with the policy of the government. The schools have little role in curriculum and syllabus construction activities. They simply implement it.

1.5. OBJECTIVES OF THE STUDY

The objectives of the present study were as follows:

- 1.) To study
 - a. the science education programme mainly in terms of:
 - i) Physical facilities, i.e., laboratory, science equipments and apparatuses, chemicals, teaching aids, library, etc.,
 - ii) Budget allocations for science education programme,
 - iii) Science teachers: their academic qualifications, professional training, teaching experiences, age, sex and weekly teaching load;
 - iv) Methods of teaching followed in the classroom,
 - v) Evaluation procedures followed in evaluating students' achievements in science,
 - vi) The problems faced by the teachers in teaching science in the school.

- b. the existing science textbooks in terms of their physical aspects, content, illustrations, language and end-of-the chapter exercises.
2. To study the science education practices in some selected schools with better results and varied physical facilities relating to:
- i) Teaching procedures in the classroom in actual teaching-learning process;
 - ii) Co-curricular activities to strengthen science education in the school;
 - iii) Strategies of evaluating students' achievements in science;
 - iv) Assistance from outside agencies for the development of science education programme in the school;
 - v) Problems of science teaching;
 - vi) Attitude of students in science;
 - vii) Attitude of teachers towards their teaching profession.

1.6. LIMITATION AND SCOPE OF THE STUDY

An investigation into the science education programme in the secondary schools of Bangladesh involves the study of the objectives of science education, assessment of curriculum and syllabus, textbooks of science, facilities available in the schools for science education and many others. In a single study, it is not possible to cover all these aspects,

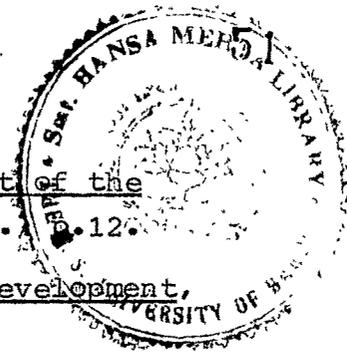
specially when an investigator has to work in a fixed time limit. The investigator of the present work had an earnest zeal to cover all the aspects of science education in this study. But due to his time constraint, he had to limit the scope of study as indicated below:

- (1) There are about 6000 secondary schools in Bangladesh. The study has therefore, been proposed to confine only within a sample of 500 schools.
- (2) Only the high schools would be included in the sample. The junior high schools offering instructions up to standard 8th are excluded from the scope of this study. The Madrashes and technical schools though are equivalent to the high schools of the country, are not coming within the scope of this study.
- (3) Research on science education is related to its multifaced dimensions and only a few have been mentioned above, out of these, the present study would cover only the school programme and its effect in terms of students' attitudes towards science and science textbooks.

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