CHAPTER 2

REVIEW OF THE PREVIOUS RESEARCHES

2.1. INTRODUCTION

In this chapter an attempt has been made to provide an examination of previous researches which have bearing on the present investigation. This is essentially an important part of any research project as it gives the investigator a background of thinking in a problem area. Through review of researches, one can get a clear perspective of the problem under study. It equips the investigator with new understanding and insight which subsequently helps in planning the study properly and in selecting or developing tools for data collection and in adopting techniques for the analysis and interpretation of data.

The task of review of researches in past has been worked out here in two sections. The first section deals with the review of researches related to the science education programme and the second section deals with the study of some textbooks.

2.2 REVIEW OF RESEARCHES IN SCIENCE EDUCATION

The review of researches already done in science education programme have been presented here in three heads,

namely, (1) Works in Bangladesh, (2) Works in India, and (3) Works in other countries. Further, the review has been presented separately in sub-heads according to the level of education under each of the above mentioned major heads.

2.2.1. Works in Bangladesh

Research activities in the area of education in Bangladesh are scanty in comparison with some other countries like U.S.A., U.K., India, etc. The area of science education in particular, received little attention of the researchers of the country. Researches in science education, whatever has been done in the past, relating to the present study are mentioned below:

Islam[1] conducted a survey on 'availability of science teachers' throughout the country covering all the fiftyfive government and 2139 non-government schools. He found that both the government and non-government schools were running with an acute shortage of science teachers in 1966. The average number of science teachers per school was 2.6 in government schools and 0.7 in non-government schools of that period.

Mandal[2] in his study of twelve high schools of Mymensingh town, showed that in most of the non-government schools science was taught by non-science graduate teachers. Practical works were not at all rarranged for the students. Lecture was the only method of teaching science in the schools.

Most of the non-government schools were lacking in science laboratory, equipments, apparatus and other allied materials. The examination question-papers were generally loaded with only essay type questions.

Islam[3] studied the problems of science education in the eight government and thirtyseven non-government schools. His major findings were:

The average number of trained and untrained science teachers per school were 2.1 and 0.5 respectively in the government schools and 0.10 and 0.15 respectively in the non-government schools. All the science teachers of both government and non-government schools were over-loaded with teaching periods. Besides science, the teachers had to teach mathematics, geography and hygiene. The academic qualifications of science teachers were poor. The average age of science teachers were 28.8 years in government and 24.1 years in non-government schools. The facilities of science teaching in the schools were very poor in the whole country.

Muttaqui[4] and others reported the position of science education in Bangladesh, Science Policy, structure of school education system, science enrolment in school, science curriculum, evaluation mechanisms and production of equipments for science teaching were focused in the reports.

2.2.2. Works in India

India being a developing country, is not lagging behind in any field of human inquiries. Rather, it is marching forward steadily in all aspects of life. India's contribution to the discipline of education is remarkable. Most of the universities and other special institutions are now the centres of research in education. A lot of researches on various aspects of education have been done already. The researches in science education which are available in the literature are reviewed here briefly.

2.2.2.1. Secondary Level

Muddu[5] studied the problems of biology teachers in teaching biological science in thirty schools of Hyderabad. The major findings of this study were as follows:

Besides biology, the teachers were teaching other subjects which resulted their high teaching load. Most of the school laboratories were lacking in proper equipments and materials necessary for biology teaching. Majority of teachers reported that separate periods were not there in the time-table for biology practical classes and the biology textbooks were not effective for teaching. Most of the schools were having poor library facilities and 63 percent of the school libraries had not general biology books.

Rajput[6] and others surveyed the science laboratories of secondary schools of western regions of India. They found that 68.7, 91.43 and 28.57 percent of the schools of Madhaya Pradesh did not have water, gas and electricity supply respectively in their laboratories. It has been known from their report that 10 percent of the schools in the state of Madhya Pradesh, Gujarat and Maharashtra had no laboratories at all. They further reported that the teachers of these schools had diverse problems in conducting the laboratory works. Lack of vacant period for practical works, separate laboratory, laboratory assistant, big class-size and time constraint were some of the problems mentioned.

Muddu[7] surveyed the status of instructional procedures of biology in thirty high schools of Hyderabad with the object to know (i) the mode of instruction adopted in biology teaching; (ii) the extent to which the instructional procedure meet the demands of biology syllabus; and (iii) the facilities for teaching biology available there. The important findings of the study were as follow:

Most of the teachers were found to use lecture-demonstration methods in teaching. Sixtysix percent of the teachers gave importance to the knowledge objectives only. Application and interest aspects were accorded list preference.

Fifty nine percent of the teachers expressed that they did not have adequate classroom to teach biology. Eightyfive

percent of the teachers due to non-availability of adequate teaching aids were following the instructional procedures which were not in accordance with the aims and objectives of teaching biology.

Facilities of reference books, information pamphlets, journals and general books on biology were not available in most of the schools. Only 35 percent of the students were found to maintain biology practical note books.

Venkataraman[8] in his study attempted to know the defects of science teaching by visiting the classrooms of fortysix science teachers in some selected schools of Madras. His important findings were:

The equipments available in the schools for science teaching were not sufficient according to the requirements of science syllabus. Lecture by using blackboard were the dominant method of teachers for classroom teaching. The teachers were over-loaded with teaching periods and classrooms were over-crowded. Audio-visual equipments like film projector and slide projector were available in some schools but were seldom used for want of trained teachers. The library had poor collection of science books. Botanical gardens were not there in any school.

Chakrapani and Puroshottama[9] investigated the practical works of science programme in some selected

schools of Madras district. The objective of the study was to know the facilities offered and the extent to which they meet the demand of science syllabus. Their findings were as follows:

About 50 percent of the schools had no laboratory at all. The private schools had better laboratory facilities than those managed by the Government and Municipality. Very small percentage of teachers had training in audio-visual education and about 75 percent had undergone inservice training in science teaching. About 79 percento of the schools had organised science club. Only 55 percent schools were allowing students to do practical works in the laboratory.

Panchal[10] studied the characteristics of science teachers, physical facilities, teaching and evaluating procedures and organisation of concurricular activities, pertaining to science teaching in the secondary schools of Baroda city. Her important findings were:

All the schools of Baroda city were having adequate number of B.Sc. teachers. The average number of science teachers per school was 3.1. About 78 percent of the science teachers had more than five years teaching experience. 78.3 percent of science teachers were trained. About 76 percent of the schools had science laboratory with adequate equipments and materials.

Lecture and infrequent demonstration were the methods of classroom teaching for science in the schools. Practical works were rarely arranged. The use of community resources in teaching science and conducting extramural activities like science exeursion, fair, seminar, talks, etc., for promoting science education in the schools were rare. The school libraries had sufficient books on science but none were found subscribing to any science journal. The achievements of students in science were evaluated by only essay type questions.

2.2.2.2. Primary Level

Sharma[11] undertook an investigation in order to know the position of science teaching in the eleven primary schools of Punjab. His results were as follows:

The teachers were not well equipped for teaching science. Most of the schools were lacking in science teaching facilities. The teaching methods in the classroom were not activity based according to the level.

Jaikishanlal[12] and others carried out a survey in thirtyfive elementary schools of Madras city. The objects of the study were to know the set-back of introducing revised elementary science syllabus and whether the teachers were possessing the necessary skills, abilities and talents to cope up with the new syllabus and assessing the available

facilities for teaching science. The important findings of this study are summarised hereunder:

Majority of schools were not following experimental demonstration and project method in teaching science due to the lack of proper facilities. Proper facilities and tools of science teaching were not available in the schools. Majority of teachers had inservice training in science teaching. According to the views of science teachers the inservice training in science was cursory in nature and was inadequate.

Patole[13] investigated 100 rural primary schools of Kolhapur district to focus the available facilities for science teaching. He found that only 10 percent of the schools had a complete set of equipments for practical demonstration of experiments according to the need of science syllabus. None of the school had a separates science room. All the teachers who were teaching science had S.S.C. or equivalent qualifications. The ratio of teachers to the students was much high in all schools.

2.2.3. Works Abroad

Science education is a vast field of research and has drawn the attention of research workers tremendously in advanced countries of the world. Hundreds of works have been carried out in different aspects of science education

there. Here an attempt has been made to present an overview of the researches done which have bearings on the present study. In order to do so, a thorough search has been made to trace out the related literature from all the available sources. The reports have been presented hereunder in three sub-heads, namely, research in secondary level, primary level and other areas of science education.

2.2.3.1. Secondary Level

Watkins[14] attempted to determine whether significant differences exist on demographic characteristics and education factor in 100 selected schools of the state of Arkansas. He found significant difference between the mean scores of the students of schools with number of courses offered, science teachers to students ratio and adequacy of the equipments available to the students.

Two educational factors were also found by Watkins in this study to be related to students achievements, namely, demographic setting of the schools and the number of science courses offered.

Coffe[15] studied the status of environmental science curriculum on the basis of the opinion from 341 life science teachers of Oregon state, U.S.A. The major findings of the study were as follows:

The objectives of science teaching were focussed more on the understanding of the environment and developing

an application for it than helping students to solve environmental problems. The most of the instructional materials came from textbooks and materials developed by the staff. The content came primarily from the interest of the teachers. The highest ranking constraint for curriculum development was lack of time.

Al-saif[16] in his study attempted to prepare a guideline for the development of science education programme for Saudi Arabian secondary schools. On the basis of the background of Saudi Arabian students and comparing the qualifications of science teachers and science education programme of Saudi Arabia with those of U.S.A., he emphasised the major changes in the following aspects for the improvement of science education there.

(1) Teacher preparation programmes both pre and inservice.

(2) Science teaching facilities which include classrooms, laboratories, equipments and apparatuses, libraries and teaching aids.

(3) Objectives of science education.

(4) Curriculum and syllabus.

(5) Textbooks of science.

Mahmud[17] conducted a longitudinal study on the curricular practices in 100 schools of ten states in the U.S.A. in order to identify the status of science teaching and

changes that had occured in science curricula and school practices during the period of 1979-80.

The results of the status study were described in the report. He compared the data to the 1970-71 study and to several recent nation-wide studies. Similarities and differences between this study and other studies were indicated. Most data were consistent with previous studies. Substantial decrease in total enrolment occurred between 1971 and 1979. Only a slight decrease occurred in the percentage of students enrolled in science between 1971 and 1980. A greater variety of courses were offered in 1980, while laboratory instruction was used by many teachers, the emphasis on laboratory instruction decreased between 1971 and 1980.

Ekpo[18] investigated the chemistry laboratory safety practices in some selected high schools of Alabama. He found most teachers saw the need for a chemistry laboratory module for high schools. This investigation revealed that the students in a few schools had inadequate knowledge concerning the correct use of available body protective equipments such as fire blanket, safety showers, eye wash fountain, and in most cases, were unaware of hazards of laboratory equipments and chemicals. In many schools, there were improper storage procedures for chemicals and lack of proper routine disposal. There was a lack of systematic reporting mechanism of accident. The investigation to many schools revealed that they were lacking in adequate first aid facilities and

personnel to give first aid in case of emergencies.

Bruno[19] studied the science education of thirty secondary schools of Nebraska with a view to focussing the science courses offering, course pattern, instructional methods and media, training of teachers. The important conclusions of the study were:

The metropolitan and urban schools were offering more advanced and specialised courses in science than the rural schools. The science teachers were using the traditional media and teaching methods in the classroom frequently. Special facilities were used infrequently for teaching science even if, they were available in the schools. The science classes were found smaller in size in the rural schools than both metropolitan and urban schools. The metropolitan schools were providing more provisions for students of varying abilities than either urban or rural schools with regard to science education. The rural science teachers were involved in teaching more non-science courses than either metropolitan or urban teachers. All the science teachers had preservice training and half of them had inservice training in science teaching.

Taylor[20] in his project on 'Planning of facilities for teaching science in the secondary schools' attempted to prepare a document which will supply step by step

guidance to science teachers, administrators, architects who are involved in planning and designing facilities in teaching science in Ohio State, U.S.A. He stressed on three premises throughout the document and these were:

(1) Science programme should be planned and objectives stated before science facilities are designed.

(2) Science facilities should be designed with flexibility, potential for expansion and adaptability in minds.

(3) The minds of many, namely, educators, professionals and lay citizens should be employed in planning and designing of science facilities.

Al-Mazyed[21] investigated the background of science teachers, facilities, equipments, supplies, and the extent of use of instructional aids in science teaching. Fortytwo public secondary schools of Saudi Arabia was the sample of this investigation. The study discovered the following major facts:

Less than 6 percent of science teachers in the public schools were indigenous and the rest were foreigners. The academic and preservice preparation of the majority of science teachers were weak and most of them had no inservice training. Lecture and demonstration as well as laboratory works were the dominant teaching methods employed byteachers

in the classroom. The science teachers of most of the schools reported that the science facilities, equipments and supplies were either inadequate or not available in the schools. The teaching in most of the schools were found textbook centred. Other printed media and instructional aids were non-existent in the schools.

Thompson[22] attempted to give the answer to his research question "what schould be taking place in science education in Oregon for grade-12" basing the opinions of different strata of people. He, in fact, collected the data from 1,042 elementary teachers, 1,310 secondary science teachers and 1,13,794 secondary students. Opinions of science specialists and administrators were also collected by the researcher in this regard. The main findings of the study were as follows:

Poor facilities, lack of equipments and teaching aids were no longer considered to be the barriers to effective science teaching. On the contrary, poor academic qualifications and training were thought to be the real obstacles for effective science teaching. The schools were mostly found inadequately equipped with science teaching materials, lecture-demonstration was the dominant method of teaching science in those classes.

Baker[23] surveyed the status of science education in 2,077 public schools of South-East region of the U.S.A. The

objectives of this survey were to focus the practices, procedures, policies and conditions of science teaching. His major findings were briefed hereunder:

About 50 percent of the schools had annual budgets for science education programme one to two US dollars per students. Fortynine percent of the schools introduced homogeneous grouping system in the classes. These system were frequent in grade seven to twelve.

The study revealed that the three most common science facilities available to more than 16 percent teachers were science dark-room, nature-trail and closed circuit television. The most commonly used learning activities used by the science teachers were: lecture-discussion instruction, group laboratory instruction and individual laboratory instruction.

Walker[24] studied the instructional difficulties of beginning high school science teachers of sixty schools of Arkansas, U.S.A. He found that the majority of teachers were not adequately prepared for teaching science at high school level. They had neither majored in science nor had studied science method course as minor. The teachers were hindered in their teaching by the lack of equipments, teaching aids and financial support from the administrators.

Fifer[25] analysed the academic qualifications of science teachers of secondary schools of Texas relating to

school setting and expressed interest. His conclusions were as follows:

No significant difference in academic training was there in terms of school location and salary. On the other hand, significant difference in teacher interest in training was found in terms of salary but not in terms of school location.

Thallaerathil[26] surveyed the status of science teaching in 294 Nigerian secondary schools with a view to focussing the scenerio of science education and evaluation of performance of students in science. The important findings of his study were summarised hereunder:

One tenth of weekly class-time was devoted to science teaching in the school time-table. The curriculum was leaned heavily towards teacher oriented programme. The laboratory experiences provided to the students were illustrative type. Community resources were not explored for science education to relate science to the environment. The syllabus was examination centred and had strong emphasis on factual knowledge and it neglected the applicability of science to daily life. Science textbooks made abroad were in use in great majority of schools. Use of necessary teaching aids in the classroom were rare. Essay type tests were widely used in evaluating students achievements in science.

Promtep[27] carried out an investigation on science teaching in 139 secondary schools of Bangkok City, Thailand. She focussed the characteristics of science teachers, methods of teaching science and evaluation procedures to evaluate the achievements in science of students in her study. The important findings of this study were as follows:

Majority of science teachers were women and the average age of both sex fell within the range of 25 - 26 years. Sixtyseven percent of them had graduation degree in education and about fifty percent received inservice training. The teachers were all over-loaded with teaching periods.

Lecturing was the dominant method for classroom teaching in the schools. Other methods were sparsely used, Long term lesson planning was absent. Only twentytwo percent teachers were found to prepare the daily lesson plan for classroom teaching.

Both essay and objective type of questions were in use to evaluate students achievements in science. Maximum number of recall questions were found to set in the question papers.

Sawyerr[28] studied the status of science education in sixteen high schools of Siera Leone Province, West Africa. The main focus of the study was on the characteristics of science teachers, performance of the students and facilities

of science education. His results were summerised below:

The average number of science teachers per school was found to be four. Sixtytwo percent of them were graduate.

Eightyeight percent of students passed the general certificate examination. The results of biological science was remarkable in all those schools. The second most remarkable good result was in health science.

About 13 percent of the schools had no science laboratory and 25 percents schools had single laboratory. While constructing science laboratory, specialists were not consulted at all. Most of the headmasters were found not interested in science education.

2.2.3.2. Primary Level

'Illinoise Science Education Cooperative[29] surveyed the status of science education in the 489 elementary schools of Illinoise, in order to know the time spent in teaching science, curricular programme used, obstacles of science teaching in schools and sources of assistance receiving for the improvement of science education. The major findings were as follows:

About 58.5 minutes were devoted to science instruction per week for pupils. Textbooks were the only means of teaching science in the schools.

Lack of science background of teachers who were teaching science was the most cited obstacle in teaching science in the schools. Inadequate physical facilities, teaching aids, supplies, big class-size and lack of individual instructional materials were mentioned as the obstacles for science education. The schools were receiving assistance from the administrator of school districts for the improvement of science education.

Brown[30] undertook an investigation relating to the implementation of science curricula and the problems associated with such implementation in California elementary schools. The data were collected from 860 science specialists and 1,017 elementry science teachers of California. The conclusion of the study was that the emphasis given on elementary science was extremely low. New materials for science teaching had not been successfully implemented. The current organization of elementary science instruction programme was ineffective. Students' participation in science activities were 44 minutes in average per week. One third of the teachers were untrained.

Nelson[31] conducted a study on science teaching in 2,948 elementry schools in New England, Mid-Eastern and South-East part of the U.S.A. The main objectives of the study were toto known the teaching practices, teacher characteristics and instructional materials. His important findings revealed that the most dominant form of science curricular materials used for instruction were single textbooks or

locally prepared materials. Lecture-discussion was the frequently used teaching methods in the classroom.

The teaching practices were found to be correlated with teacher's training, availability of supplies and equipments and various factors which limit teaching effectiveness.

Smith[32] carried out a study in order to compare the growths in science achievements of the students of three grades; and to determine the relationship of achievements among certain student() variable and teacher variable. Two hundred students and sixtyeight science teachers of sixteen schools of south-western Michigan were the sample of this study. His major findings revealed that:

1) Types of community (urban, sub-urban, and rural) did not seem to be related to the growth in the science achievements of the students.
2) Students' growth in science achievements were independent of sex factor.
3) Students who had teachers with 10-14 years teaching experience made significantly greater gains in science achievements than those who had less than ten years and more than fifteen years experiences.

Webb[33] studied the procedures, practices and conditions related to science teaching in 3,421 elementry schools of south-east region of the U.S.A. The important

findings of this study revealed that the best predictors of science teaching practices were inservice training activities, semister-hour credits in methods of teaching science, undergraduate and graduate semister-hour credit in science content, grade level taught, teachers' sex and availability of supplies.

The best predictors of teachers satisfaction with elementry school science were training in science content, availability of supplies and grade level taught.

The factors that represent the greater deterrent to effective science teaching were inadequate room-facilities, lack of equipments and supplies and insufficient funds for purchasing supplies. The textbooks were found as predominant instructional materials for teaching science in schools.

Siripala[34] surveyed the science education practices of fortyfive elementry schools of Bangkok City with the purpose of knowing characteristics of science teachers, teaching and evaluating procedures and problems of science teaching. The important findings of this study were as follows:

Most of the teachers had diploma in education and majority of them were female. All the teachers were overloaded with teaching periods. 'Chalk and talk' was the dominant method of teaching in the classroom, demonstration and practical works in science were rarely followed.

Equipments and other teaching aids were not available in the schools for teaching science. Essay questions were in use in evaluating the students' achievements in science in all the schools. Inservice training facilities were not available to the teachers for their professional growth.

2.3. RESEARCH IN OTHER ASPECTS RELATED TO SCIENCE EDUCATION

Mugiri[35] studied the factors affecting the implementation of science curricula in the secondary schools in Kenya. The investigator, as a result of this study formulated five major categories of factors that affect implementation of science curriculur programmes. These were: policy and administration for the implementation of the programme, institutional organization and administration, adoption and adaptation of science programmes to meet institutional and students' needs, the instructional programme and the quality of science teaching resources available in schools.

Gallaghar[36] surveyed science educators' perceptions regarding the problems facing "Science Education in U.S.A.". Six categories of responses were received from 144 respondents, namely, (i) conceptual, (ii) organizational, (iii) teacher related, (iv) student related (v) university related, and (vi) societal. Out of these six, conceptual

problem received the attention of 31 percent respondents. University related and organizational problems were cited by 23 and 21 percent respondents respectively. Societal, teacher and student related problems were mentioned as less important problems of science education in the contemporary periods.

Besides the above mentioned general problems, the investigator reported uncertainity of goals and objectives of science education, lack of vision and leadership in schools and universities, public and parental apathy towards science education, limited budget and physical facilities, poor quality and low standard of teacher education programme, inappropriate testing procedures, lack of incentives for professional growth, poor quality of teaching, etc., were the problems that science education of the U.S.A. facing.

Mian[37] in his study on historical development of science education in Bangladesh compiled the information regarding the introduction of science education, its development and culmination from ancient period to 1977 in a single volume.

2.4. RESEARCH ON TEXTBOOKS

Research in the area of textbook preparation, production and evaluation in Bangladesh has remained still untouched. It has, however, been recognized that preparation and production of quality textbooks depends largely on the gradual and

constant study and evaluation of the same. This area of research is drawing the increasing attention of the researchers in other countries.

Here an attempt has been made to present a brief sketch of the researches done in India and other countries in the area of textbooks.

Usha[38] analysed the chapter-end-questions of six Thai science textbooks of lower secondary schools in terms of Solan's taxonomy of knowledge. She found, knowledge questions were of highest percentage and were irregularly distributed within and between the textbooks for each grade level. A very low percentages of higher order questions were found in the chapter-end-questions of each science textbook.

Fathhi[39] analysed the Iranian biology and geology textbooks with the object to determine the readability, structure of content and the characteristics of the content. His conclusions were as follows:

Inquiry approach was followed in the textbooks. The reading difficulty of both the books were higher than the intended grade level. The end-of-the chapter questions in the biology textbooks were mostly in low level cognitive domains and inadequate and below average. The inadequate assignment and exercises in the textbooks needed restructuring

basing on the objectives of the course, bibliography, unit reference and chapter summaries were not given due and adequate weightage.

Lene[40] investigated the illustration of secondary earth science textbooks of Austin, Texas with a view to (i) identifying the level of accuracy with which students were able to interpret textbook illustration, (ii) showing illustrations could be improved through modification of design factor and that information needed for the improvement of illustration can be obtained from students for whom they were designed.

The results of the investigation showed that the design factors which cause error in the interpretation of illustration by students can be identified by analysis of test answer and interview with students. The study showed further that information gained from the test answer and interview could be used to identify poor design factor in illustration. Successful redesign of illustration to improve their efficiency was difficult and require further study.

Chawdhury[41] evaluated the nationalised Hindi textbooks of class I to VIII in terms of strengths and weakness, values, needs and themes with the help of opinions of teachers, students and experts. The exercises given at the end of the chapters were also analysed to know the cognitive level of questions there. The main conclusions of this study

were:

The students had a more favourable opinion of all the eight textbooks than their teachers. There was no agreement between the values presented in the textbooks of class V to VIII and the values recommended by the experts. The questions given in the exercises of the textbooks were predominantly at low cogmitive level. The female teachers and female students had no favourable opinion of the textbooks than their counterparts.

Sentill[42] analysed textbooks of social studies for elementary level of Latin American schools with the object to know the extent to which certain basic ideas about the country were present in them by means of content analysis techniques. His finding indicated that the books contained less than 60 percent of the specified ideas underlied in the model.

Rastogi[43] and others carried out a comparative study of textbooks of mother tongue of primary classes in Bengali, Gujarati, Hindi, Telegue and Urdu. The focus of this study was on lessons, exercises, illustrations, ancillary materials, physical aspects, content of the textbooks and weightage given to the different components of the content and instructional objectives.

SIE, Orissa[44] evaluated the effectiveness of the experimental textbooks "Science is doing" for Class III prepared by NCERT for the students of Orissa. The major findings were as follows:

The physical aspects of the textbooks under study were judged to be good except get-up. Some portions of the textbooks were suggested to be eliminated by the respondents as they were found unsuitable for the pupils of the age group 7^{+}. A change in order of arrangement of chapters were prescribed by the majority of the respondents. Some experiments set in the book were considered difficult for class III. More illustrations were required to be given in the book. The pictures given in the book were found to be useful. Extra classroom works under the caption 'things to do at home' were found to be dissatisfactory by the respondents.

Pattabhiram[45] evaluated the nationalised textbooks of social studies of secondary stage. The design and lay-out, content and objectives to be attained by the pupils through these textbooks were the interest of the evaluation. The important findings were as follows:

All the nationalised textbooks were rated as satisfactory with regard to the physical characteristics but there was room for the improvement of design, stitching and wrapper. All the textbooks in general had adequate content

but readjustment in some units were felt needed. The presentation of content and illustration were rated below average in these nationalised textbooks. Assignments and exercises were considered inadequate and needed restructuring on the basis of objectives of the course. The nationalised textbooks were found better in quality and quantity in comparision with old textbooks, but there were enough rooms for making qualitative improvements.

2.5. AN OVERVIEW OF THE RESEARCHES REVIEWED

The works which have thus far beem reviewed in the preceding sections of this chapter were in majority in the status of science education in different title covering primary and secondary stage of education in home and abroad. The rest were on the problems, planning of facilities and historical development of science education. Most of the aforesaid studies were of survey types.

The investigators who carried out status studies on science education embraced in most cases, only a few aspects among physical facilities, teacher characteristics, teaching methods, evaluation procedures, exploration of community resources, cocurricular activities, library facilities, textbooks, etc., as the dimensions of science education in their investigations. But important dimensions like financial provisions for science education, science syllabus and management of science education received little attention of

those investigators except Baker[46], who showed per student expenditure in science education in his study.

Some studies out of the total 45 reviewed here, were on the problems of science education. The researchers in those studies focussed the problems of science teachers, both quality and quantity, physical facilities and textbooks. Gallaghar[47] studied the general problems of science education in U.S.A. This study was comprehensive and recemt. The other researchers devoted themselves to the specific problems. As for instance, Muddu[48] highlighted the problems of teaching only biological science in India. Islam[49] on the other hand, investigated the problems of science teachers and physical facilities long back in East Pakistan (present Bangladesh). The problems of production and distribution of science textbooks, financial allocations and management of science education in the schools, etc., could have been the interest of the investigators for study. These aspects of problems of science education have not got place in those researches.

Miah's[50] study was a kind of compilation of historical facts about the development of science education in Bangladesh from ancient period to the last decades. He did not formulate any objectives of his study and follow any strict methodology in it.

The researches reviewed in the area of textbooks were not comprehensive and exhaustive by nature except Pattabhiram's[51] study. He investigated in depth, almost all the aspects of social study textbooks of secondary stage in India. Other investigators, in most cases, highlighted only one or two aspects of textbooks among physical aspects, illustrations, content, language style, exercises, etc.

In most cases except Miah[52], questionnaires either structured or unstructured were used as tools for data collection by the investigators. Of course, Gallaghar[53] used only open ended questions in his tools. Some of the investigators took resort to interview and check-lists as supplimentry devices for their data collection depending on the nature and objectives of their study. Observation of science teaching practices in actual classroom situation and investigation into the development of attitudes of students towards science were not found in any study thus far reviewed here.

2.6. IMPLICATIONS OF THE TREND OF RESEARCHES ON SCIENCE EDUCATION FOR THE PRESENT STUDY

The review of research studies is not a routine work for a researcher. Rather it is a necessary step as it provides immense clue to the investigator. The foregoing discussion on the review of research studies in the area of

science education crystalises some issues, observations and ideas, on the basis of which the investigator attempted to formulate his research questions and objectives of this study. The issues, observations and ideas and their implication on the present study are given below:

(1) Research in the area of science education has never been attempted either by the students as their academic exercise or by the institutions which are entrusted to conduct educational research in the country since the creation of independent Bangladesh. Even before independence, science education as an area of research, received a very little attention of the researchers in the country. After a thorough search into the literature in Bangladesh, it has been found that only Islam[54] and Mandal[55] carried out investigation on science education about 15 years back when science just entered into the school curriculum as a compulsory subject in the country in a real sense. The results of these investigations have lost their validity with the change of time and situation. Moreover, Islam's[56] focus was only on the problems and availability of science teachers in the secondary schools. On the other hand, Mandal[57] conducted his study on twelve selected schools of a district town. Through the findings of his study one is not able to get the total picture of science education of the entire country. Therefore, a gap in respect of data about the science education in the secondary level of education was always there in

Bangladesh which has been perceived from the review of research. The present study is expected to go a long way to fill up these gaps.

(2) Most of the researches reviewed in this chapter were conducted on science education in both primary and secondary level of education in the countries abroad. The geographical socio-economic and cultural milieu of these foreign countries are not similar to those of Bangladesh. The objectives and needs of the stress of science education can not be the same in all those countries. Accordingly the science education programme are also likely to vary from country to country. Therefore, the findings of those studeis have a very restricted significance in Bangladesh situation. Further, a large number of works reviewed were conducted long back, and in the mean time they perhaps have lost their validity even in the countries, where, they had been conducted. Therefore, the study on science education programme at school level of education in Bangladesh is, in fact, important at the present watershed when the Government of the country is giving high importance and priority to it.

(3) The present investigation is attempting to seek answer to some leading questions pertaining to science education of Bangladesh. These questions have already been cited in caption 1.2 in the previous chapter. The answer to those questions are, in fact, closely related to the data regarding

some of the aspects of science education. The review of researches provided the investigator an idea about those aspects. This idea helped him to single out the appropriate aspects of science education which would go a long way to give the answer to those questions. Thus basing on the idea the investigator formulated the aspects of science education for the present study.

(4) The researches reviewed in the foregoing sections enlightened the investigator about the methodologies in terms of sample, tools for data collection and analysis and interpretation of data. These in turn helped him to develop his methodology for the present study properly.

REFERENCES

1. Islam, Md. Nurul, "Availability of Science Teachers in the Secondary Schools of East Pakistan", East Pakistan Education Extension Centre Bulletin, Dhaka: Vol.VI, No.3-4, 1967.

2. Mandal, Dilip Kumar, "A study of Science Teaching in Some Selected Secondary High Schools of Mymensingh Town", unpublished M.Ed. thesis, T.T.College, Mymensingh, 1967.

3. Islam, Md. Nurul, "Problems of Science Education in the High Schools of East Pakistan", East Pakistan Education Extension Centre Bulletin, Dhaka: Vol.IX, No.1, 1970.

4. Muttaqui, Iqbal Aziz et.al. "Position of Science Education in Bangladesh", Dhaka: Institute of Education and Research, University of Dhaka, 1983. (UNESCO Project).

5. Muddu, V. "A Study of the Problems of Biology Teachers in Teaching Biology in High Schools," Department of Education, Osmania University, (UGC, India, Financed), 1978.

6. Rajput and Others, "A Survey on Science Laboratory in the Secondary Schools of Western Region", Abstract, Educational Trend, New Delhi: Vol.13, No.1, 1978.

7. Muddu, V. "A Study of Prevalent Status of Instructional Procedures in Biology in High School", Department of Education, Osmania University, Hyderabad: (UGC, India Finance), 1978.

8. Venkataraman, G. "General Science in the High Schools". Abstract, Experiment in Science Education, Madras: Vol.4, No.5, 1976.

9. Chakrapani, R, and S. Puroshottama, "A study of Practical Works in the Science Programme in the Secondary Schools". Abstract, Journal of Educational Research and Extension, Madras: Vol.II, No.4, 1975.

10. Panchal, B.R. "A Study on Science Education Programme in the Secondary Schools of Baroda City," Unpublished M.Ed. Dissertation, M.S. University, Baroda. 1967.

11. Sarma, N.D. "An Experimental Study of Teaching Natural Science at the Primary Level in Central Schools of Punjab", An unpublished Doctoral Dissertation, Patna University, 1978.

12. Jaikishanlal, S. "A Critical Study of Science Teaching in Primary School", Abstract, Journal of Educational Research and Extension, Madras: Vol.13, No.2, 1976.

13. Patole, N.K. "A Study of Teaching of Science in Rural Primary Schools", A Ph.D. Thesis, Pune University, 1967, Abstract, A Survey of Research in Education, edited by M.B. Buch, CASE, Faculty of Education and Psychology, M.S. University, Baroda, 1974.

14. Watkins, W.E. "Analysis of the Pattern of Science Education in Metropolitan, Small Town and Rural Secondary Schools in Arkansas and their Relationships to Students' Achievement in Science" Doctoral Dissertation, Arkansas State University, 1982, Abstract. Dissertation Abstract International, Vol.43, No.10, 1983, P.3281-A.

15. Coffey, Don. "Environmental Education in the Life Science Curriculum in the Secondary Schools in the State of Oregon", Doctoral Dissertation, University of Oregon, 1982, Abstract. Dissertation Abstract International, Vol.43, No.9, 1983, p.2872-A.

16. Alsaif, S.M. "Recommended Guideline for the Science Education Programme in the Public Secondary Schools of Saudi Arabia", Doctoral Dissertation, University Wyoming, 1981, Abstract. Dissertation Abstract International, Vol.43, No.4, 1982, p.1103-A.

17. Mahmud, H.B. "Secondary School Science Curricular Practices: A Ten Years Longitudinal Study of Schools in Ten States", Doctoral Dissertation. The Ohio State University, 1981, Abstract. Dissertation Abstract International, Vol.42, No.5, 1981, p.2056-A.

18. Ekpo, Juj. "A Survey of Chemistry Laboratory Safety Practices in Selected High Schools of Alabama and a Proposed Chemistry Laboratory Safety Module", Doctoral Dissertation, The University of Alabama, 1980, Abstract, Dissertation Abstract International, Vol.41, No.8, 1981, p.3516-A.

19. Bruno, R.J. "Science Education in the High Schools of Nebraska" Doctoral Dissertation, The University of Nebraska, 1978. Abstract, Dissertation Abstract International, Vol.39, No.7, 1979, p.303-A.

20. Taylor, P.H. "Planning of Facilities for Teaching Science in the Secondary Schools" Doctoral Dissertation, Duke University, 1977. Abstract, Dissertation Abstract International, Vol.38, No.8, 1978, p.4714-A.

21. Al-Mazyed M.I. "Science Education in the Public Secondary Schools in Saudi Arabia" Doctoral Dissertation, University of Oregon, 1975, Abstract, Dissertation Abstract International, Vol.36, No.7, 1976, p.4377-A.

22. Thompson, E.T. "Survey of Status of Science Education in Oregon During 1973-74", Doctoral Dissertation, Oregon State University, Abstract, Dissertation Abstract International, Vol.35, No.7, 1975, p.4225-A.

23. Baker, J.H. "A Survey of Science Teaching in the Public Secondary Schools of the Plains, Rocky Mountain and South East Region of U.S.A." Doctoral Dissertation, Ohio State University, 1973, Abstract, Dissertation Abstract International, Vol.34, No.5, 1973, p.2419-A.

24. Walker, J.K. "Instructional Difficulties of Beginning Junior High School Science Teachers in Arkansas" Abstract. Dissertation Abstract International, Vol.34, No.5, 1973, p.2416-A.

25. Fifer, F.L. "An Analysis of the Academic Qualification of Selected Earth Science Teachers in Texas, Relating to School Setting and Expressed In-service Interest" Georze Peobody College for Teachers, 1973. Abstract Dissertation Abstract International, Vol.34, No.7, 1974, p.4024-A.

26. Thallaerathil, H. "Analysis and Evaluation of Science Teaching in the Nigerian Secondary Schools" Doctoral Dissertation. Colorado State University, Abstract, Dissertation Abstract International, Vol.32, No.11, 1972, p.5638-A.

27. Promtep, K. "A Study of Teaching Science in Lower Secondary Govt. Schools in Bankok", M.Ed. Dissertation, Abstract of Educational Research, Bangkok: Nai Chaleo Chuntara Sup. Printer Publisher, 1970, p.67.

28. Sawyerr, E.S. "Science Education in the High Schools of Sierra, West Africa" Abstract, Science Education, New York: Vol.53, No.1, 1969, p.21.

29. Illinoise Science Education Cooperative, "Survey of Science Education in the sample of Illinoise elementry Schools", Abstract, Science Education, New York: Vol.63, No.4, 1979.

30. Brown, E.H. "An Assessment of Science Education Program in California Elementry Schools" Doctoral Dissertation, University of California, 1977, Abstract, Dissertation Abstract International, Vol.38, No.8, 1978, p.4709-A.

31. Nelson, B.E. "A Survey of Science Teaching in the Public Elementry Schools of New England, the Mid-East and South East Region of the United States, During the 1970-71 School Year" Doctoral Dissertation, The Ohio State University, 1973, Abstract, Dissertation Abstract International, Vol.34, No.8, 1974, p.4913-A.

32. Smith, B.A. "Modern Elementary Science Curricula and Student Achievement" Doctoral Dissertation, Western Michigan University, 1972, Abstract. Dissertation Abstract International, Vol.33, No.8, 1973, p.4202-A.

33. Webb, N.R. "Teaching Science in Public Elementry Schools of the Plains, Rocky Mountain and South East Region of U.S.A.", Doctoral Dissertation. The Ohio State University, 1972, Abstract, Dissertation Abstract International, Vol.33, No.8, 1973, p.4203-A.

34. Siripala, K. "A Study of Science Teaching Practices in Bangkok Municipal Elementry School" Abstract of Educational Research, 1965-69, Bankgok: Nai Chaleo, Sup.Priner Publisher, 1970, p.67.

35. Mugiri, E.M.O "Factor Affecting the Implementation of Secondary School Science Curricula Program in Kenya" Doctoral Dissertation, University of Massachusetts, 1981, Abstract, Dissertation Abstract International, Vol.42, No.3, 1981, p.988-A.

36. Gallaghar Science Educators' Perception of the Problem Facing Science Education of U.S.A." Journal of Research in Science Teaching, New York: Vol.18, No.6, 1981, p.505.

37. Miah, G.R. "Historical Development of Science Education in Bangladesh", Unpublished Doctoral Dissertation, University of Hirosima, Japan, 1981.

38. Usha, S. "An Analysis of Knowledge level of Questions Appearing at the End of Each Chapter of Science Textbooks used in Thai Lower Secondary Schools" Doctoral Dissertation, Southern Illinoise University at Carborala, 1982, Abstract. Dissertation Abstract International, Vol.43, No.9, 1983, p.2305.A.

39. Fathhi, A.E. "Analysis of Science Textbooks used in Iranian Upper Secondary Schools" Doctoral Dissertation. University of Illinoise at Urbanana Champiam, 1981, Abstract. Dissertation Abstract International, Vol.42, No.9, 1982, p.3945-A.

40. Lene, G.W. "An Investigation of Textbook Illustration in Secondary Earth Science" Doctoral Dissertation, University of Texas, 1981. Abstract. Dissertation Abstract International, Vol.42, No.3, 1981, p.1086-A.

41. Chowdhury, T.S "An Evaluation of Nationalised Hindi Textbooks (Class I through VIII) of Madhya Pradesh. Doctoral Dissertation, Indore University, 1976.

42. Sentill, J.E.J. "Elementary Social Studies Textbooks: Content Analysis", Doctoral Dissertation, Aubury University, 1976 Abstract, Dissertation Abstract International, Vol.37, No.9, 1977, p.5791-A.

43. Rastogi, G.K. et al, "A Comparative Study of Mother Tongue Textbooks Prescribed for Primary Classes in Bengali, Gujarati, Hindi, Telegue and Urdu", N.C.E.R.T. Project, Delhi, 1975.

44. S.I.E. (Orissa) : "Development of Evaluation Form and Evaluating Effectiveness of the Experimental Textbook Science is doing for Class III" prepared by N.C.E.R.T. for Orissa Schools, 1975.

45. Pattabhiram G. "An Evaluation of Nationalised Textbooks for higher classes in Social Studies in the Secondary Schools of Andhra Pradesh", Doctoral Dissertation, M.S. University of Baroda, 1973.

46. Baker, op.cit.,

47. Gallaghar, op.cit.

48. Muddu, op.cit.

49. Islam, op.cit.

50. Miah, op.cit.

51. Pattabhiram, op.cit.

52. Miah, op.cit.

53. Gallaghar, op.cit.

54. Islam, op.cit.
55. Mandal, op.cit.
56. Islam, op.cit.
57. Mandal, op.cit.