CHAPTER 3

PLAN AND PROCEDURE

3.1. INTRODUCTION

Plan and procedure form very important steps in carrying out a research work. The successful completion of any research project depends largely on a well thought out plan and systematic procedures. The whole work of the present investigation was planned to be completed in two Phases. Because, the data of one phase were used partly in conducting the works of the other phase of investigation. Detailed outline of the plan and the procedure of work, which have been followed in this study are being discussed in this chapter.

3.2. THE FIRST PHASE OF THE STUDY

The work of first phase is for the realization of objectives 1.a. and 1.b vide caption 1.5 of the first chapter.

3.2.1. The Survey

A survey was planned for the collection of data from the secondary schools of the country relating to the objective 1.a as indicated above. The heads of the schools were the subjects of this survey.

3.2.1.1. The Population of the Survey

There are 6,469 secondary schools in Bangladesh.[1] These schools offer five year schooling leading to the award of 'Secondary School Certificate' after a Public Examination conducted by Board of Intermediate and Secondary Education. The five year secondary courses consist of five classes from 6th grade to 10th grade. These secondary schools are scattered all over the country. The present study includes all the secondary schools in Bangladesh within the purview of survey as target population.

3.2.1.2. The Sample

It has been proposed to conduct the survey with a sample of 500 schools of the country. Since the high schools of Bangladesh can be categorized as government and non-government, urban and rural, and boys' and girls', the sample of the study, had been selected by using stratified sampling technique embracing all these categories of schools in order to make it representative. There may be some co-educational high schools in the rural areas of the country, but their number is unknown, even there is no mention of the co-educational schools separately in the government records. So the inclusion of the coeducational schools as a separate stratum in this sample was not possible.

The government schools, both boys and girls, are all situated in the town and city areas of the country. Not

a single government school has been found in the rural areas of the country thus far. Therefore, only six categories of secondary schools in Bangladesh have been included under the study. The schools situated in five cities, that is in Dhaka, Chittagong, Narayanganj, Rajshahi, and Khulna and in the municipal areas of districts and sub-divisional head quarters are termed as Urban school in this study. The categories of schools along with their number in each, constituting the total sample are shown in the table 3.1 below:

Table No.3.1 : Break up of Sample

Category of Sample		No.of schools (target population)	Size of the selected sample
Location	Types of school		
Urban	GB	112	9
	GG	72	6
	G.total	184	15
	NGB	632	49
	NGG	408	32
	NG. Total	1040	81
	Urban Total	1224	96
Rural	NGB	4756	366
	NGG	489	38
	Rural Total	5245	404
Grand Total		6469	500

Here the abbreviation GB, GG, NGB, NGG, G and NG stand for government boys, government girls, non-government boys, non-government girls, government and non-government schools respectively and also throughout this report.

3.2.1.3. Tools

In order to collect data for the survey, a questionnaire was used as instrument and it was constructed by the investigator. To prepare the instrument the investigator in the beginning consulted some of the science education specialists, teacher educators, headmasters and some experienced science teachers of Bangladesh relating to the various aspects of science education in the secondary schools of the country. Some faculty members of the Centre of Advanced Study in Education, M.S. University of Baroda, Baroda; Bangladesh Education Extension and Research Institute (BEERI), Dhaka and Institute of Education and Research (IER), University of Dhaka, were also consulted. Further, the reports of Bangladesh Education Commission, 1974 and National Curriculum and Syllabus Committee of 1977 were consulted too. The review of research done in the previous chapter on science education were of immense help to the investigator in identifying the dimensions of science education programme of secondary schools and the information needed in preparing the questionnaire.

While preparing the questionnaire, attention had been given to cover the following aspects of science education programme of Bangladesh:

1) The general information of the school.
2) The allocation of time for science teaching in the school.
3) The physical facilities of the school for science teaching.
4) Yearly budget allocations for science education in the school.
5) The characteristics of science teachers in the school.
6) Methods and procedures used in teaching science in the schools.
7) Extramural activities organized in strengthening science education in the school.
8) Evaluation procedures employed in schools in evaluating the students' learning in science.
9) The problems of science education in the school.

A draft questionnaire consisting of 118 items covering all the above mentioned dimensions was first prepared. It was then edited carefully and got examined by a language specialist in order to insure that each of the items of the questionnaire was clear and unambiguous from language point of view.

The draft questionnaire was further given to a group of experts to judge the adequacy and appropriateness of it. Two faculty members from the Centre of Advanced Study in Education, M.S. University, Baroda two from IER, University of Dhaka and one from BEERI, Dhaka were among the group of experts. The list of experts who examined the questionnaire is annexed in the appendix 9. On the basis of the suggestions and views of the experts the questionnaire was modified and then it was used for a pilot study in actual situation.

3.2.1.4. Pilot Study

Since the study aimed at covering the whole of Bangladesh and since the schools of different strata of sample had science teachers with different backgrounds, the questionnaire and its language should be made understandable to all of them. Further the common teachers in Bangladesh are not well aware of educational research and they are not at home in handling this type of questionnaire in general. So to make the questionnaire understandable and see whether the subjects can handle the instrument with ease, a pilot study was planned and conducted in 10 of the high schools of Bangladesh covering both urban and rural areas. The pilot study also helped to identify the inappropriate items in the questionnaire.

3.2.1.5. Final Form of the Questionnaire

After analysis of the responses of the pilot study, the questionnaire was again modified to make it ready for use. The final questionnaire consisted of 9 sections with main 81 items. The sections and the number of items in each are shown below:

	Sections	No.of Items
1.	General information	8
2.	Time allocation for science teaching	5
3.	Physical facilities	30
4.	Budget allocation for science education	7
5.	Characteristics of science teachers	1
6.	Teaching procedures	14
7.	Extramural activities	7
8.	Evaluation procedures	8
9.	Problems of science education	1
	Total Number of Items	: 81

A copy of the questionnaire has been attached in the appendix 1.

3.2.1.6. Data Collection

The schools under the sample were scattered throughout Bangladesh. Due to the time constraint, collection of

data by personal visit to each of the schools by the investigator was not possible. Hence, the mailing technique was adopted for data collection in this phase of study. The investigator first took permission from the Director General, Secondary and Higher Education, Bangladesh, to collect data for this study from the schools of the country. The questionnaire, already discussed under the caption 3.2.1.5 above was mailed directly to the heads of the sampled schools. A self addressed envelope with requisite postal stamps was also provided along with the questionnaire for convenience and quick return. A forwarding letter addressed to the heads of the schools was also attached indicating the background and importance of the study. The instructions regarding how to respond to the questions of the questionnaire were also given in it. An appeal was also made to return the questionnaire duly responded at an early date after its receipt. A month after the completion of mailing, first reminder was issued to the heads of the schools who failed to send back the questionnaire within the stipulated time. A second and final reminder was given again to them who remained defaulters inspite of the first reminder.

Quite a good number of questionnaires were discarded owning to partial or total faulty response. Some questionnaires, after return from the schools were found without the signature of the head of the school and official seal. These were also

set aside. The number of schools found with valid questionnaires are shown in the table 3.2 below which constitute the final effective sample of the study.

Table No.3.2 : Selected Sample and Responded Sample.

Location	Category of school	Selected sample size	Responded sample size	
Urban	GB	9	9	(100.00)
	GG	6	6	(100.00)
	G.total	15	15	(100.00)
	NGB	49	45	(91.84)
	NGG	32	25	(78.13)
	NG total	81	70	(86.42)
	Urban total	96	85	(93.41)
Rural	NGB	366	220	(60.11)
	NGG	38	26	(68.42)
	NG total	404	246	(60.89)
	Grand total	500	331	(66.20)

Figures within bracket indicate percentage of responses.

The final sample size was 331 which consisted of 66.20 percent of the total 500 selected for the study.

3.2.2. The Study of Science Textbooks

The study of science textbooks was also done in the first phase of the investigation. This part of the study was done by analysing all the science textbooks of standards VI to X by the investigator himself. In addition to this exercise the investigator also collected opinion from 25 experts in science education through an opinionnaire constructed by him. The views of classroom teachers and students were also taken into consideration.

3.2.2.1. Criteria for Analysis

The national curriculum and syllabus committee[2], 1977, while preparing the syllabus set clear cut criteria for the preparation of science textbooks. The investigator adopted these criteria for analysing the science textbooks in this study. The above mentioned criteria are detailed hereunder:

1) Quality of Paper : Best quality of papers should be used in printing science textbooks.

2) Cover : The cover of the science textbooks should be bright and appealing.

3) Letters to be Used in Printing the Books: (a) 12 point pica for main body, (b) 10 point pica for the caption of diagram, picture, etc., and (c) bold letters in other places.

4) Size of the Book : The size of all the Science textbooks should be 9" x 7" in size.

5) Total Pages : The number of total pages should not exceed (a) 125 in case of class VI (b) 150 in case of class VII (c) 200 in case of class VIII and (d) 600 in case of class IX and X.

6) Glossary of scientific terms : The glossary of Scientific (technical) terms used should be given in alphabetic order at the end of the each science textbook.

7) Pictorial Illustration : Adequate pictorial illustrations should be set in the books.

8) Experiments : Adequate experiments should be set in the books showing the use of locally made apparatus and indigenous materials.

9) Language : Bengali spoken language should be the language of the textbook.

10) Spelling : Uniform spelling style of Bengali words should be used throughout the textbooks.

In addition to the above, questions given in the exercises at the end of each chapters of the textbooks were analysed in terms of seven hierarchal categories of taxonomy developed by Bloom and his associates and later on elaborated by Saunders, with a view to identifying the cognitive level of the same.

The task of analysis of the textbooks as mentioned above were done by the investigator himself using an analysis

sheet in accordance with all the above mentioned criteria. A copy of the analysis sheet is attached in appendix 2. The opinions of experts in science education, and curriculum specialists were also collected by means of an opinionnaire in respect of the existing science textbooks of the country.

3.1.2.2. Construction of Opinionnaire for Science Textbooks

In order to know the views of the experts in science education and curriculum specialists regarding the existing science textbooks an opinionnaire was developed with 29 items covering the following aspects:

1) Physical aspects.
2) Content and mode of presentation.
3) Language.
4) Illustration.
5) Exercises at the end of each chapter.
6) General remarks about the textbooks.

A copy of the opinionnaire has been attached in the appendix 3.

3.3. THE SECOND PHASE OF THE STUDY

The second phase of the study pertaining to objective 2, vide caption 1.5, of the first chapter, was planned with a view to undertaking an intensive investigation about the practices of science education in 10 selected schools as case studies.

Science education programme in schools involves doing a lot of planned activities to achieve the desired goals and the better results in science. Here an attempt has been made to focus on:

(1) a) recruitment of science teachers;
b) utilization of available physical facilities;
c) teaching procedure in the classroom;
d) extramural activities to augment science education;
e) evaluation strategies;
f) exploring assistance from outside agencies for the improvement of science education.

(2) the nature of development of attitude of the students towards science and the attitude of science teachers towards their teaching profession.

Since one of the expected outcomes of science education is the development of favourable attitude of students towards science, this has been emphasised in the report of National Curriculum and Syllabus, 1977.[3]

3.3.1. Tools Used for Data Collection in Phase Two of the Study

In order to collect data for this phase five different tools were used. These tools were :

1) An interview schedule for heads of the schools.
2) An interview schedule for the science teachers.

3) An observation schedule for the science teaching procedures in the classroom situation.

4) A scale to assess the attitude of students towards science.

5) A scale to assess the attitude of science teachers towards their teaching profession.

3.3.1.1. Interview Schedule for the Heads of the Schools.

The purpose of interview with the heads of the schools was to know the practices of science education in the concerned schools. So, while constructing the schedule an attempt has been made to reflect the following aspects relating to the science education practices of the schools.

1) recruitment of science teachers and admission policy of students;

2) institutional importance given to science;

3) Cooperation sought for the improvement of science education;

4) problems of science education in the school.

The schedule was constructed by the investigator himself and got examined for its adequacy by the experts from the Centre of Advanced Study in Education, M.S. University, Baroda; IER, University of Dhaka and BEERI, Dhaka. A copy of the schedule is attached in the appendix 4.

3.3.1.2. Interview Schedule for the Science Teachers

This was an unstructured schedule for science

teachers for information about the science education programme of the schools and science textbooks, and this was prepared by the investigator himself. A copy of the schedule is attached in the appendix 5.

3.3.1.3. Observation Schedule

In the preparation of this schedule, initially the investigator went thoroughly through the various classroom teaching observation devices prepared by different authors and researchers. Thus, taking the ideas from the literature the investigator outlined his observation schedule. It was then tried out in some schools of Dhaka city. On the basis of the experiences of trial observation of classes, it was modified for final use. A copy of the same is attached in appendix 6.

3.3.1.4. Attitude Scales

Two attitude scales were developed for this study. One for measuring the attitude of the students towards science and the other for the science teachers towards their profession.

Psychologists have developed various methods for constructing attitude scales. Each method has its own advantages as well as limitations. However, it depends on the investigators to select the methods of constructing the scale for their studies. This section discusses in brief the construction of the scale which involves collection of statements

taking opinion of the experts in respect of their clarity and language.

Usually it is desireable to select and prepare a large number of statements than are likely to be used in the final scale, because after scrutiny some statements may not be found satisfactory for desired purpose and some may not be suitable from the language point of view too.

The investigator constructed both the scales by Thurstone Method. To this end, he formulated statements from his experience and literature pertaining to the topics, such as earlier dissertations, periodicals, magazines, etc. Initially there were 80 statements covering all possible aspects of attitude for each of the scale. The following criteria were kept in view while formulating and selecting the statements for each of the scales concerned:

1) statements were to be the expression of desired behaviour and the statements of facts;
2) statements were to be expressed in clear, concise and straightforward language;
3) confusing statements with ambiguous meaning or vague wording were to be avoided;
4) each statement was to convey a single idea.

Almost equal number of positive and negative statements were culled following the criteria mentioned

above and were given to language specialists for their opinion in respect of clarity. On the basis of the opinion of the expert the scales were modified and the number of statements was reduced to 50 in each.

3.3.1.4.1.Ratings From the Judges

All the statements of both the scales were typed separately for obtaining the ratings by the judges. The ratings of the judges were collected by following the procedure of Seashore and Evner[4]. Two separate sheets of paper with 11 cells superscribing 1 to 11 were provided in order, from left to the right horizontally against the serial number of each statement. Both the statement sheets and rating sheets were given to the judges for their ratings. The judges were requested to rate those statements which they believe to express highest positive attitude in cell '1', the neutral attitude in cell '6' and those expressing strongest negative attitude in cell '11'. In intervening cells the rating of statements should be made in accordance with the degree of positive and negative attitude they expressed.[5] Detailed instruction had been given in a separate letter to the judges.

Now the question was from how many judges the rating should be obtained? The researches on attitude measurement by Thurstone Method do not provide any clearcut answer to this question in the pioneering studies. Thurstone

and Chave[6] obtained ratings from 300 judges. Edward and Kenny[7] reported a correlation of 0.95 between the scale values for 129 statements obtaining ratings from 72 judges and scale values for the same number of statements based upon the ratings of 300 judges. Uhrbrook[8] obtained ratings on 279 statements from two groups of 50 judges and found the correlation of 0.99 between ratings of the two groups. A further interesting finding regarding the high correlation of 0.99 reported by Rosander[9] for scale values obtained independently from two groups with as few as 15 judges in each. Yadav [10] et al. obtained ratings for 55 statements from different number of judges ranging from 20 to 130 in different groups. They reported that reliable scale values for attitude statements could be obtained by ratings from 20 judges. Mia[11] obtained ratings from 25 judges for preparing an attitude scale for his doctoral study.

In view of the facts mentioned above, the investigator decided to obtain ratings for 50 statements for both the scales from 25 judges.

The judges from whom the ratings were obtained were drawn from different educational institutions. Among them were teacher educators and research scholars from Centre of Advanced Study in Education M.S. University of Baroda, Institute of Education and Research, University of Dhaka and Bangladesh Education Extension and Research Institute, Dhaka.

3.3.1.4.2. Final Form of the Attitude Scales

After collection of ratings for all the statements by all the judges, the Q-value and the median of ratings for each statement was computed. The statements of higher Q-value upto 7.00, totalling 30 in number were retained in the final scale in both the cases.

The order of arrangement of the statements were random in the final form of both the scales. The final form of both the scales are attached in the appendices 7 and 8.

In the instruction, the subjects were asked to put a tick mark in the blank space provided against each statement with which he/she agreed and keep blank with which he/she disagreed. His/her score would be the sum of the median values of those statements with which he/she agreed.

3.3.1.5. Sample : Selection of Schools (Phase Two)

On the basis of data collected in first phase of the study, the schools with better results were classified into two groups as 'high' and 'low' according to the physical facilities. Last three years results of Secondary School Certificate (S.S.C.) Examinations were considered as criteria of selecting the schools of better results. However, the classification of schools into two groups as mentioned above was made on the basis of the standing of schools regarding the following aspects:

1) Science laboratory.

2) Furniture of the laboratory.

3) Stock of apparatuses, chemicals and other materials.

4) Stock of teaching aids.

5) Annual financial allocations.

6) Library facilities.

3.3.2. Data Collection

The investigator in consultation with his guide selected 10 schools, 5 from each group as mentioned under caption 3.3.1.5 for collection of data in this phase. He personally visited all the 10 schools and stayed in each about a week for data collection. During his stay in each school he took the interview of the school heads, science teachers and took informal interviews of the students in group, administered the attitude scales to the teachers and students, collected the results of last annual examination in science from the school records. The science teachers of each school rendered their help and cooperation in administering the attitude scale to the students and collecting the results of science from the school records. The attitude scale was, in fact, administered to 30 students selected randomly from each classes of VI, VIII and X only. Special care was taken to select those students who were admitted to the school in class VI and had been continuing their study in the school. The secondary school course of

Bangladesh has two separate stages, namely, lower secondary and secondary. The class VI is the initial and class VIII is the final class of lower secondary stage. Similarly class IX is the initial and Class X is the final step of secondary stage. The investigator due to time constraint administered the attitude scale in classes VI, VIII and X covering both the stages of secondary education.

3.4. LANGUAGE OF THE TOOLS

Initially all the tools were prepared in English and then they were translated into Bengali except the interview schedules, namely, the one for the heads of the schools and the other for the science teachers. While data collection the Bengali version of the above mentioned tools were administered in the actual field. But the interviews were taken in English.

3.5. ANALYSIS AND INTERPRETATION OF DATA

There were different types of items in the questionnaire used for data collection in the first phase of study. These were yes/no, multiple choice and supply of the figures. The responses to each yes/no and multiple choice types were analysed in terms of the frequency of the respondents' agreements with a particular response out of the total number of respondents. The frequencies were further converted into percentages. The responses of each item of supply-figure type were recorded in a table for all the respondents and

further analysed suitably, while analysing the items under the problems of science education in school an arbitrary weightage was assigned to each category of responses of a particular problem. Here weightages '2' for 'very much a problem','1' for 'to some extent a problem' and '0' for 'not at all a problem' were given. Total summated scores for each item was computed and ranked to ascertain the position; and the rank correlation of the scores between different strata of the schools were calculated and interpreted accordingly.

The data in respect of the science textbooks were analysed by assigning weightage in a similar manner as mentioned above. On the other hand, the information obtained by the analysis of the textbooks, interview with science teachers and students were analysed and interpreted descriptively.

Again the data from the interview of headmasters/ headmistresses, science teachers and students during the second phase of the study were analysed and interpreted descriptively. However, the attitude scores were first analysed in terms of mean of median value,[12] for each student for each school. Secondly, product moment coefficient of correlation 'r' between the science achievement scores and attitude scores was computed for each class. Further, the attitude scores of science teachers were analysed in terms of mean of median value.

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