# CHAPTER - 5

## CASE STUDY

### 5.1. INTRODUCTION

This chapter deals with the reporting of the results of case study in ten schools under the second phase of investigation pertaining to the objective 2 vide caption 1.5. of the Chapter 1. The criteria of selecting these schools have already been indicated in caption 3.32 in Chapter 3 broadly. However, the detailed procedures of selection of these schools were as follows:

### 5.2. PROCEDURES OF SELECTING SCHOOLS

In effect, a list of all the sampled schools was first prepared with three years' (1980-1982) average results of S.S.C. examinations in science in terms of percentage of pass pertaining to the data of caption 4.2.1.7 vide Chapter 4. The schools with the percentage of pass of students in science within the range of 90-100 were sorted out and their number was only 38. These 38 schools were looked up as schools of better results in science.

These 38 schools were then categorized into two groups as 'high' and 'low' facility schools on closer examination of data described in caption 4.2.3.2, 4.2.3.3,

4.2.3.5, 4.2.3.7 and 4.2.4.2, vide chapter 4. The schools having three planned science laboratories with adequate furniture, equipments, apparatuses, chemicals, teaching aids, annual budget allocations for science education and more than average number of books on science in the library were termed as 'high' facility schools in this study. The number of such schools with high facility was only 9 out of 38. The remaining 29 schools were termed as with 'low' facility'. However, out of these 38, 10 schools, 5 from 'high' and 5 from 'low' groups were selected for conducting the study in this phase. While selecting 5 schools from each of 'high' and 'low' groups, consideration was given to both old and new schools as mentioned in caption 4.1.2.1. Chapter 4 for their inclusion. Further, due to the time limitation, schools with better communication were also kept in view in selecting the schools from each group.

The methods of data collection for the second phase of study have been indicated in detail in caption 3.3.8, vide Chapter 3. The information, thus, collected by means of 5 different tools as mentioned in caption 3.2.1 of same chapter are presented here separately for each school.

## 5.3. HIGH FACILITY SCHOOLS

The schools with high facility do not imply that they had enough science teaching facilities according to the

curricular need. Rather, it means that these schools had higher science teaching facilities in comparison to other schools in the sample.

### 5.3.1. School 'A'

It is a government boys' school in a subdivisional town in the district of Rajshahi in Bangladesh. It was established in 1896. The school is housed in a building. For the last few years, 100 percent of the students of this school were coming out successful in science in the "Secondary School Certificate (S.S.C.)" examinations conducted by the Education Board.

#### The Science Teachers and Their Recruitment

At the time of visit of this school by the investigator, there were four B.Sc. science teachers in the school. All of them had B.Ed. training and had 18.6 years teaching experience in average. Very recently they all underwent inservice training in science teaching for 15 days.

The recruitment of teachers in the government schools of the country is made by the Public Service Commission (PSC) through an open competitive examination and is appointed by the Director General, Secondary and Higher Education, Bangladesh.

Admission Policy and Enrolment

The seats to the government schools are limited in each class. These schools are generally manned by well-qualified teachers and provide better facilities to the learners. The tution fees on the other hand are very low in comparison to all other types of schools. For these reasons people prefer to get their children admitted to these schools. Hence, the admissions to the government schools are always competitive. On the basis of the results of admission test, the children are selected in order of merit for admission.

At the time of visit to this school 600 students were found to study there. Each class consisted of two sections. Thus, the average class-size was 60 which was much higher than the optimum size 40 as indicated in caption 4.2.1.5 vide Chapter 4. On the other hand, the ratio of science teachers to the students were 1:150. This ratio is also higher than the estimated ratio vide caption 4.2.1.5, Chapter 4. This indicates clearly that the school was in shortage of science teachers.

Teaching Practices in the Classroom

The investigator observed twelve science periods in this school. Out of these twelve periods, three were in chemistry, four in physics and five in biology. All the

five classes from VI to X were observed. Moreover, one chemistry practical period was also observed.

The facts that came out of the observation of classroom practices are presented here in detail.

1. The science teachers were not found at all to bring written lesson plans in the classroom. They admitted later that they do not prepare any formal lesson plan in science for classroom teaching. But they take preparation in advance by reading the textbooks and they go to class with their own mental plan as to the presentation of materials before the class.

2. In all the periods the science teachers were found to introduce the lesson by asking questions bearing on previous knowledge of the pupils.

3. The objectives of the lesson were not stated by the teachers in any science period either in broad term or specific behavioural term.

4. The teachers were very much prone to take resort to lecture method in all the periods. Intermittent discussion and questioning were sparsely used. In a few periods in classes IX and X, the teacher instead of using true demonstration, used 'blackboard demonstration'. Blackboard demonstration is a simulative type of demonstration where,

instead of using real apparatuses and other materials and doing actual experiments, the teacher draws diagram of the apparatus on the blackboard, describes procedure of experiments, states the facts, principles and conclusions before the students. All the science teachers admitted that most of their demonstration lessons are of blackboard demonstration type though school had adequate facilities in this regard. It has been told that for lack of time and excessive teaching load they could not take preparation for the actual demonstration of lesson. On the other hand, in lower classes from VI to VIII, lecturing was the eclusive method of teaching science there.

5. None of the teachers were seen to use teaching aids in any science period. While visiting the laboratory, later, the investigator found a good stock of wall charts, pictures, diagrams on various science concepts. A slide projector and an overhead projector were also there.

6. At the end of each period all the teachers hurriedly evaluated the outcome of the lesson by asking oral questions only. Homeworks were found to be assigned only to lower classes (VI - VIII).

7. The nature of laboratory work was mechanical and imitative. The teacher first demonstrated the experiment before the students and then they were

asked to do the same. What they were doing and why, were unknown to them.

It has been reported that laboratory practicals were provided only to the students of Class X. Only one period had been allotted for practicals in a week in the school time-table.

Organization of Extramural Activities for Strengthening of Science Education

It has been known from the headmaster and the science teachers that the school was organizing only science exhibition annually. There was no science club in this school, but the headmaster was thinking to form it soon.

Strategies for the Evaluation of Students' Achievements in Science

Term system had been introduced in the school. The one year course of study of each subject of all classes had been distributed almost equally over three terms consisting of four months each. At the end of each term there was an examination, for the purpose of evaluation of the performance of students. The results of all the terminal examinations were looked on equally for the promotion of the students from one class to the next higher class. The performances in science are also evaluated in the same way as

above. It has been reported that essay, short-answer and objective types of questions are used in evaluating the achievements of students in science in this school. Besides these formal three terminal examinations, the science teachers reported to have organized fortnightly and monthly tests in science in the classroom in an informal manner according to their convenience for constant student appraisal.

It has been told that the results of all the terminal examinations are shown to the students to make them aware of their positions and also to the parents for their perusal.

Attitude of the Students towards Science

In order to assess the attitude of the students towards science, the scale as indicated under caption 3.3.1.4 vide chapter three was administered in classes VI, VII and X in accordance with the plan described in caption 3.2.3 of the same chapter.

The mean score of attitude of students of each class in terms of 11 point scale was 2.92 for class VI, 2.34 for VIII and 2.38 for X. They are all in the favourable direction in the continuum in which point '6' is neutral. Therefore, from the means it can be said that the students of all classes were possessing favourable attitudes towards science and were stronger in comparison to neutral point '6'.

However, in order to know the pattern of the development of attitude with the achievement in science in this school the product-moment coefficient of correlation 'r' between the scores of science achievement and attitude of the students in the whole class as well as 'high' and 'low' achievement groups in each of the three classes were computed and are shown in Table 5.1.

Table 5.1 : The Coefficient of Correlation between Achievement and Attitude Scores, School 'A'

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | - .31 | - .32 | - .35 |
| VII | - .32 | - .28 | - .38 |
| X | - .43* | - .15 | - .11 |

The 'r's as are seen in table 5.1, all are with negative signs. It may be mentioned here that the scale used in measuring the attitude had its extreme positive attitude on point '1' , Neutral on '6' and extreme negative on '11' in the continuum. Hence, lower the score of an individual in this scale, higher is his positive attitude. On the other hand, higher the score in science higher is his achievement in it. Thus the negative sign of the correlation here shows positive relationship between science achievement and attitude

towards science. This explanation for negative sign of 'r' will hold true for all the tables of results presented later in this chapter, vide table nos.5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, and 5.10.

The correlation 'r' in the whole as well as in the high and low achievement groups of all the classes are not significant. However, all these means that the development of attitude with the achievement of science of students of this school of all classes though had positive relationships, but the development of attitude as evident from the magnitude of 'r' is quite low.

Attitude of Science Teachers towards Teaching Profession

The attitude scores of four science teachers of this school were found to be 1.92, 2.18, 2.26 and 2.88 and their average was 2.31 by administering the scale mentioned in caption 3.2.1.4 in Chapter 3, which indicate positive attitude of the teachers towards their teaching profession.

Library Facility

The school has a very good library with about 3500 books. But the number of books on science was only 125. Majority of the science books were of textbook types. The students and the science teachers were not using these books properly.

Exploration of Assistance and Cooperation from External

There are quite good number of agencies in Bangladesh, which extend help and cooperation in the form of consultancy service, training to science teachers, donating scientific books and apparatuses to the secondary schools of the country. Among these agencies, important are UNESCO, Asia Foundation, British Council, Bangladesh Audivisual Education Centre (BAEC), Bangladesh Equipment Development Board (BEDB) and National Institute of Education Administration, Extension and Research (NIEAER). All are in Dhaka, the capital city of the country.

It has been known from the headmaster and the science teachers of this school that the school was in close contact with some of the above agencies. The school has already collected science apparatuses from UNESCO, teaching aids from BAFC, and books from Asia Foundation. According to the views of science teachers the science apparatuses of UNESCO and books of Asia Foundation were not useful for high school level of science education. In respect of teaching aids of BAEC, they expressed, these were quite useful.

The school was utilizing the inservice training facilities of NIEAER and all the science teachers have recently received two weeks' training in science teaching from this Institution.

Problem of Science Education

Being a government institution this school was not free from problems regarding its science education programme. One of the very important problem as mentioned by the headmaster was the shortage of science teachers. The upshot of which was their teaching load. They could not take proper care to the students in teaching due to their high teaching load. Another problem which is very sensitive to handle, according to the headmaster of the school is the reckless indulgence to private tuition by the science teachers, which creates both academic and administrative problem in the school.

5.2.2. School 'B'

This is a nongovernment boys' school in a rural area of Jessore district in Bangladesh. It was established in 1936. The school is housed in a two storied building. The main sources of income of the school are tuition fees and government grants. During the last three years 94 percent of the students in average were passing in the S.S.C. examinations from this school.

Science Teachers and Their Recruitment

At the time of the investigator's visit, there were three science teachers in the school. All were science graduates with 14.3 years of teaching experience in average. Only one of them had B.Ed. training. None of them undertook any inservice training in science teaching during their service

career.

The school had no special recruitment rules for the appointment of science teacher. The school generally appoints science graduates as science teachers. It has been known from the headmaster that academically better qualified science graduates are highly demanded in other sectors of the job market and they hardly come to take up teaching profession specially in the rural area. The school, in this circumstances, cannot select science graduates with good academic qualifications, teaching experiences and training for appointment as science teachers.

Admission Policy and Enrolment

Admission of students to this school is rather open. The entry stage for admission is class VI in this school. Admission is generally held in the month of January, but it continues for several months. Admission to other classes are also entertained.

The school record tells that 408 students were studying there at the time of visit to the school by the investigator. The average class-size was 81.6. There was no section in any of the classes. The class-size was obviously much higher than the optimum size 40 as pointed out in caption 4.2.1.5, Chapter 4. The ratio of science teachers to the students was 1:136 in this chool which was also much higher than the estimated ratio as indicated in caption 4.2.1.5, Chapter 4. This clearly indicates that the school was in shortage of science teachers.

Teaching Practices in the Classroom

The investigator observed eight science periods during his one week stay in the school. Out of the eight, one was in physics, three were in chemistry and four were in biology. The observation covered all the five classes from VI to X. No practical period of science was observed here. It has been learnt that the school arranges practical works only for the students of class X and is generally held at the end of school session for three months period only.

The facts that emerged out of this observation of classroom practices are summarised here:

1. The science teachers were not found with lesson plans in the classroom. It had been told later, that the science teachers do not prepare any lesson plan altogether, but they reported to have taken preparation before hand for the lessons. It has been known that long term planning of activities of science teaching are not done, but they tentatively plan at the beginning of the session about the number of chapters of science textbook they are going to teach in the first half and second half of the year.

2. None of the science teachers were found to make the class mentally ready for receiving the new lesson by any device. They straightway begin to impart the lesson by lecture.

3. The objectives of the lesson were not stated in any form, broad or behavioural, by the science teachers before the class. They all, even the trained science teacher too, at the time of interview, admitted that their ideas about 'objectives' are not clear.

4. The science teachers use lecture method in teaching with the help of blackboard most of the time in all the periods. Discussion and questioning techniques are sparsely followed.

5. Teaching aids are not found in use in the classroom at all, in any period.

6. The outcomes of lesson were not evaluated properly in any of the period. In most periods the teachers were found to complete the works of evaluation by asking a few oral questions to the students in a cursory manner.

7. In all periods the teachers had given homework from exercises of the science textbooks. Later, it had been admitted by the teachers that they do not examine the home work due to their time constraint.

Organization of Extramural Activities for Strengthening of Science Education

It has been reported that the school was organizing science exhibition annually. The students make the exhibits by themselves in their home and display them in the exhibition. The school was also participating in the National

Science Exhibition during the last five years.

Strategies for the Evaluation of Students Achievement in Science

The school holds two examinations in a year. One is half-yearly and the other is annual. The achievements of students in all the subjects including science are evaluated by means of these two examinations only. It has been learnt that the promotion of the students depends solely on the results of annual examination. Besides these two formal examination the science teachers were occasionally arranging weekly and monthly examinations in the classroom whenever they feel necessary according to the reports of the teachers.

It has been reported that only essay and short answer type questions were set in the examination question papers for evaluating science performance of the students in this school.

The results of both the half-yearly and annual examinations are shown to the parents of the students regularly through progress reports.

Attitude of the Students towards Science

The mean attitude score of the students was found to be 5.26 for class VI, 4.65 for class VIII and 4.61 for class X in terms of 11 point continuum. The attitude score of each class thus, shows clearly that the students were

possessing favourable attitude. But the magnitudes of means as are seen here show that the attitude of students of class VI was very low which comes near the neutral point '6' of the scale. The attitude of the students of class VIII and X were also low.

However, with a view to knowing the mode of development of attitude with achievement in science, the product-moment coefficient of correlation 'r' between science scores and the attitude scores of the students were computed and are shown in table 5.26.

Table 5.26 : Coefficient of Correlation between Science and Attitude Score, School 'B'

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.24 | -.33 | -.20 |
| VIII | -.58* | -.67* | -.34 |
| X | -.60* | -.69* | -.20 |

*Significant at .01 level.

The 'r's as are indicated in table 5.26, are all with negative signs. This negative sign of the correlation, in fact, shows positive relationship between science achievement and attitude scores of the students of all classes, vide explanation after table 5.15. The 'r's of class VI in

whole class and also in high and low achievement groups were not significant which means the development of attitude with science achievement in class VI were very low.

On the other hand, 'r's of class VIII and X in whole classes well as in high achievement group of each of them were significant at .01. But in low achievement group in the same classes were not significant. These mean that the development of attitude with science achievement whole as well as in high achievement group were high in classes VIII and X, but low in low achievement group in the same classes.

Attitude of Science Teachers towards Teaching Profession

The attitude scores of three science teachers were 2.84, 2.94 and 3.04 and the average is 2.94 which indicates favourable attitude of teachers of this school towards teaching profession.

Library

It has been reported that the school library had about 1600 books of which 55 were on science. Excepting a few, the books of science were not generally borrowed by the students. Even the science teachers are not much interested to take books from the school library.

Exploration of Assistance and Cooperation from External Agencies

The school authority was not seel aware of the institutions that are functioning in the country and offering

services and assistance for the improvement of science education. The school was only familiar with Bangladesh Audovisual Education Centre and received visual teaching aids like pictures, charts, diagrams, etc., from it in the past.

Problems of Science Education

It has been learnt that the school is solvent to the extent that it can afford to pay the salary of teachers regularly, but financial stringency is there. The school was spending TK 1200/00 (US $48.00) per year in average for science education which was inadequate to carry on the whole year's activities and replenish the laboratory with new materials. As a consequence, the school only arranges practical works for the students of class X and teach them only limited experiments for S.S.C. Examination.

The shortage of science teachers was another problem to the school. But its root was also in the stringent financial status of the school.

5.2.3. School 'C'

This is a nongovernment girls' high school in Mymensingh town and came in to being in the year 1944. The school is housed in a two storied building. The school was solvent financially. The main sources of income of the school are tuition fees from the students and government grants. For the last three years 94.1 percent of the students in average,

were passing in the S.S.C. Examination in science from this school.

Science Teachers and Their Recruitment

Four science teachers were working in the school during the visit of the investigator.there. They all were science graduates and all had B.Ed. training. The average teaching experience of them was 13.4 years. All fof them took inservice training in science teaching for two weeks.

The school does not have any specific recruitment rule of its own. But the school was appointing only science graduates as teacher of science here. The headmistress admitted that she cannot put stress to better academic qualifications and experience of teachers for appointment due to the fact that the science graduates have high demands elsewhere and do not take up teaching profession easily.

Admission Policy and Enrolment

Admission of students to this school is competitive. The entry stage for admission is class VI. Admission to other classes depends on the availability of seats.

The children are selected for admission on merit basis through written test. Thus, in the process of selection comparatively better students are selected for admission here.

It has been known from the school record that 574 students were studying in this school. Each class consisted of two sections. The average class-size was 57.4, which was bigger than the optimum size '40' as mentioned in caption 4.2.1.5, Chapter 4. The ratio of science teachers to the students was approximately 1:144 which was higher than the established ratio, cited in caption 4.2.1.5, Chapter 4. This clearly tells that the school was running with acute shortage of science.teachers.

Teaching Practices in the Classroom

The investigator observed nine science periods including one practical. Among theoretical periods, one was in physics, two were in chemistry and four were in biology. The practical period was for physics. The observation covered all the five classes from VI to X.

The analysis of the classroom practices observed by the investigator are described hereunder:

1. The teachers were not found to bring written lesson plans in any of the periods. Later, they admitted that they generally do not prepare formal lesson plan. But in some periods when they teach difficult topics, then they make informal notes for class teaching. It has been known from the science teachers that they prepare a tentative scheme of science teaching activities on term basis.

2. The teachers attempted to make the students ready mentally for the lesson by asking questions on the basis of previous lesson in most of the periods.

3. The objectives of the lesson were not stated before the class in any period either in broad or behavioural term.

4. Lecture cum demonstration techniques were followed in most of the periods with intermittent discussion and questioning. The teacher, however, admitted that most of the time they use lecture and blackboard demonstration while teaching in the classroom.

5. The teachers were seen to use teaching aids adequately. Though the school had slide projector and over-head projector, the teachers cannot use them in the classroom because they were not trained to operate them.

6. At the end of each period the teacher attempted to evaluate the outcomes of the lesson by asking oral questions. The span of evaluating phase depends on the time of the teachers.

7. The teachers were found to assign home-task to the lower classes only (VI-VIII).

8. The nature of laboratory practicals was mechanical. First, the teacher explained orally how to perform the experiment they were going to do and at the same time showed the procedures to the students. Then the students were asked to do in the same manner as the techer did.

It has been reported that the school arranges practical class only for the students of class X and it begins from the beginning of the year. Only one period had been allotted for practical works in science in a week.

Organization of Extramural Activities for Strengthening Science Education

It has been reported that the school regularly organized science exhibition annually. For the last three years, the students of this school had been participating in the national science exhibition. The science teachers with the active help of the students have organized a 'science corner' in the school. The exhibits of the science corner include hand-made apparatuses, scientific toys, models, specimens of seeds, leaves, roots of plants and dead insects and pictures of great scientists of the world. These exhibits have been kept in glass-case in the corridoor of the school.

Strategies for the Evaluation of Students' Achievement in Science

The evaluation is based on term system. There are three terms consisting of four months each. Accordingly, the one year course had been divided equally over three terms. At the end of each term there is a formal examination for the evaluation of the performance of the students. The results of all the terms are counted on cumulative basis for promotion of the students to the next higher classes. Besides these

three formal examination, the science teachers reported to have arranged casual tests in the classroom at the end of teaching each chapter of the science textbook. The progress of all the three terminal examinations along with the attendance of the students, their behaviour and participation in cocurricular activities are regularly reported to the parent of the students.

It had been learnt that essay, short answer and objective types of questions were used for the evaluation of students' performance in science.

Attitudes of the students towards Science

The average attitude score of students of each class in terms of 11 point scale was found to be 3.81 for class VI, 3.13 for class VIII and 2.91 for class X. Comparing these means with the neutral point '6' of the scale, it is evident that the attitudes of the students of all the three classes were favourable but were moderate in classes VI and VIII and comparatively high in class X.

In order to know the pattern of development of attitude with achievement in science the product-moment coefficient of correlation 'r' between attitude scores and science achievement scores were computed for each class and the value of 'r's are shown in table 5.3

Table 5.37 : Coefficient of correlation Between Achievement Scores of Science and Attitude Scores. School 'C'

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High Achievement group | Low Achievement group |
| VI | -.38 | -.31 | -.02 |
| VIII | -.61* | -.43 | -.07 |
| X | -.69* | -.63* | -.08 |

*Significant at .01 level.

The 'r's in table 5.37 are all with negative sign indicating positive relationship between science achievement and attitude in the science in all the three classes vide explanation given after table no.5.15. The value of 'r's of class VI in whole class and also in high and low achievement group were all not significant, which mean low development of attitude with the achievement of science of the students of this class.

Again in class VIII, the value of 'r' in whole class is significant at .01 level but not significant in high and low achievement group. These indicate that the development of attitude in science is high in whole class but low in both high and low group with achievements in science.

On the other hand, in class X, the 'r'siare significant at .01 level in the whole class as well as high achievement

group but insignificant for low achievement group. These clearly show that the development of attitude of class X was high in whole and high group but poor in low group.

Attitude of Science Teachers towards Teaching Profession

The attitude scores of four science teachers of the school were 1.89, 1.94, 1.96 and 2.06 and the average of which is 1.97. Comparing the average value with the neutral point '6' of 11 point scale, it is evidently indicating that all the teachers possess favourably high attitude towards their teaching profession.

Library

The school library is situated in a separate room with about 2500 books on various areas of human enquiry. However, the number of books on science was reported to be nearly 200. A trained librarian was there to run the library. The students and the science teachers both were borrowing the books on science from the library regularly. It has been learnt from the librarian that the students of higher classes were interested more in the biographies of scientists and scientific fictions.

Exploration of Assistance and Cooperation from External Agencies

It has been found that the headmistress was familiar with some of the agencies and institutions that are providing

help to the schools of the country for the improvement of science education. The school has laready collected a lot of books from Asia Foundation and all were in English language. It has been reported that these books are not suitable for school level of education. She mentioned the name of Bangladesh Audio Visual Education Centre for its production of teaching aids for science teaching. The school regularly collects teaching aids from the centre. The school never approached other institutions for help in order to improve its science education programme.

Problems of Science Education

The school was spending TK 2500.00 annually in average for the science education. But this amount, according to the views of science teachers, was not adequate. Replenishment of laboratory with new materials annually was not possible with this amount. The school was running short of science teachers. On account of financial difficulty the school could not appoint more science teachers immediately.

5.2.4. School 'D'

This is a special type of school situated in the district of Khulna. It was established in the year 1904. Its administration and management is in the hand of a body controlled by a Christian Mission. But in academic affairs the school abides by the rules and regulations of Bengladesh.

The school was housed in a double storied building. The entire school building and the campus was neat and clean. The school was financially solvent. The main sources of income of the school was the tuition fees from the students. The tuition fees were very much high in comparison to any other private school of Bengaladesh. The teachers were well paid. For the last three years 100 percent of the students were coming out successful in the S.S.C. Examinations.

Science Teachers and Their Recruitment

The headmaster of the school was a French Missionary priest. He had been working here for more than 15 years. During my visit, there were 5 science graduates in the school as science teachers. They all had B.Ed. training with 15.4 years of teaching experience in average. None of them reported to have attended any inservice training programme in Bangladesh or abroad.

The school has its own recruitment rules for the appointment of teachers. The headmaster told that they lay high importance on the better academic qualifications of teachers for appointment. Teaching experience and training are secondary considerations. Moreover, they offer better pay to attract well qualified science graduates here.

Admission Policy and Enrolment

Admission to this school was highly competitive. The entry stage is class VI. The students are selected on the

basis of written, oral and medical tests for admission. As the tuition fees are too much high, the children from high income group are only getting chance for admission to this school.

The school records revealed that 500 students were studying in this school in the five classes from VI to X. Each class consisted of two sections. The average class-size was 50 which was higher than the optimum size cited in caption 4.2.1.5. Chapter 4. Again the ratio of science teachers to the students of this school was 1:100 which was in conformity with the established ratio mentioned in caption 4.2.1.5, Chapter 4.

Teaching Practices in the Classroom

The investigator observed twelve periods of science during his visit to this school. Out of the twelve periods, one was on physics, five were on chemistry, four were on biology and two were on practical, one in physics and the other on chemistry.

The teaching practices in this school that emerged out as a result of the observation of science periods and discussion with the science teachers and the headmaster are outlined here:

1. The academic activities are conducted here on the basis of term system. The whole year is divided into three terms. The span of each term generally consists of four months. All the academic activities including course content are also distributed almost equally over these

three terms. At the very beginning of the school year the science teachers prepare their tentative scheme of teaching activities for all the three terms and get them approved by the headmaster.

2. It has been known that planning of lesson for each science period is compulsory here. The plan of lesson may be detailed or skeletal in form. So, teachers were found in all periods with lesson plan.

3. In all periods the teachers attempted to prepare the class ready mentally for the new lesson by asking questions from previous lesson, relating stories from every day experience depending on the topics of the lesson.

4. Lecture, lecture-cum-demonstration, questioning, discussion were the methods of teaching science in the classroom. Demonstration was used only at the beginning of new chapter. But lecture, discussion and questioning were in much use in classroom teaching.

5. The teachers were found to use diagrams, pictures, and models at the time of necessity to augment the lesson. None of them, were found to use slide and over-head projector in strengthening classroom teaching though these aids were there in the school.

6. The classroom climate was open. The students spontaneously come forward with questions for clarification. The teachers were found to attend the questions of the students sympathetically.

7. At the end of the period the teachers have summarized the lessons briefly on the blackboard for students' recapitulation of the lesson in consolidated form and then proceeded to evaluation of the outcome of the lesson.

8. The phase of evaluation of the lesson was completed only by asking oral questions to the students.

9. Home works were not assigned in most of the periods.

10. The practical works in the laboratory were mechanical and teacher first explained the procedures of the experiments and simultaneously did the experiment before the students. Then they were asked to do in same manner as the teacher did. The students in a group of two imitated what the teacher did.

Strategies for the Evaluation of Students' Achievement in Science

It has been mentioned above that the academic activities of the school are conducted on the basis of term system. The performance of the students in science are evaluated with other subjects at the end of each term by holding examinations. There are three examinations in a year for this purpose. The promotion of students depends on the summated results of all the three examinations. Therefore, all the three terminal examinations are equally important to them.

The results of each terminal examinations are recorded. The progress of each student for each term are regularly shown to the parents along with their attendence, behaviour, class activities through progress reports.

Besides the three formal examinations as stated above, the science teachers reported to have arranged casual classroom tests in science in an informal manner after completing teaching each of the chapters.

It has been learnt that essay, short answer and objective types of questions are used to evaluate the achievements of the students. It has been told that in lower classes particularly in class VI and VII the short answer and objective types of questions are exclusively used. On the other hand, in upper classes all the three types of questions are used in combination.

Organization of Extramural Activities for Strengthening Science Education

It has been reported that the school was organizing science exhibition annually. The students make their exhibits for the exhibition with the guidance of science teachers according to their interest. Every year five students were participating in the National Science Exhibition along with their exhibits. The school won the National trophy twice in Science Exhibition held in Dhaka.

The school was organizing a science club with the students. The club, every year organise science excursion to nearby places of scientific interest. Last year the students of class IX and X visited at Khulna a news print mill and the dock yard.

The science club has made a science corner in a separate room under the guidance of science teachers. All the exhibits of the science corner were students' hand made apparatuses, models, toys, diagrams, pictures and specimens of seeds, leaves, roots of plants, rocks, stones, soil, etc., collected jointly by the students.

Development of Attitude of Students towards Science

The mean attitude score in terms of 11 point psychological continum is found to be 4.94 for class VI, 3.81 for class VIII and 2.13 for class X. The mean attitude scores in comparison to the neutral point '6' of the scale indicate that the attitude of the students towards science were favourable. The mean scores further show that the attitude of students of class VI was very low and that of class VIII was moderate. But that of class X was high with reference to the 11 point scale.

In order to know the mode of development of attitude, coefficient of correlation between the attitude scores and the achievement scores in science of the students were computed for

the whole classes as well as in 'high' and 'low' achievement groups within each class and are shown in table 5.4 .

Table 5.4 : Coefficient of Correlation Between the Achievement Scores of Science and Attitude. School 'D'

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.10 | -.27 | -.17 |
| VIII | -.58* | -.46 | -.19 |
| X | -.71* | -.48 | -.21 |

* Significant at .01 level.

The negative sign of 'r's for all classes in table 5.4 indicate positive relationship between attitude towards science and science achievement of the students of this school, vide explanation after table no.5.4. The value of 'r's in all cases except in whole class of VIII and X are not significant indicating very poor development of attitude of the students towards science with achievement. On the other hand the 'r's whole class of VIII and X are significant at .01 level showing higher development in attitude.

Attitude of Science Teachers towards Teaching Profession

The attitude scores of 5 science teachers of the school were 1.6, 1.7, 1.9, 2.1 and 2.2 and their average was 1.9 which

evidently shows that the teachers of this school possessed high favourable attitude towards teaching profession.

Library

The school had a good library with about 4000 books. A trained librarian was there to run the library. It had been reported that about 250 books of science were in the library. Majority of the books on science were in English language.

Students and teachers regularly borrow books on science and other disciplines from the library.

Exploration of Assistance and Cooperation from External Agencies

The headmaster admitted that he never approach to any of the institutions mentioned earlier for assistance.

Problems of Science Education

The headmaster told that the scarcity of good quality science textbooks in Bengali language is the major problem of science teacheng. Besides textbooks, lace of printed materials like teachers' guide, handbooks, students' work-books, etc., in Bengali language are also problem to both the science teachers and the students for science education.

5.2.5. School 'E'

School 'E' is a nongovernment boys' high school in the rural area of Pabna district in Bangladesh. It was established

in 1917. The school is housed in a two storied building. It is financially solvent. During the last three years 91.6 percent of the students of this school is passing in the S.S.C. examinations in science.

Science Teachers and Their Recruitment

At the time of visit by the investigator to this school, four B.Sc. teachers with average 9.2 years of teaching experience were working there in the school. Out of the four only one had B.Ed. training. None of them had inservice training in science teaching.

It has been reported by the headmaster that the school authority cannot stick to the better academic qualifications and high experience for the appointment of science teacher. Because good science graduates are not produced abundantly. Moreover, what are produced have openings to other sectors. However, they could appoint a graduate in science as science teacher here.

Admission Policy and Enrolment

Admission of students to this school is open for all. Class VI is the entry stage for admission.

It has been learnt from the school records that 864 students in total were studying in this school. Each class is divided into 3 sections totalling 15 in the whole

school. The class-size in average was 57.6 and this is quite high in comparison to the optimum size as indicated in caption 4.2.1.5, Chapter 4. On the other hand, the ratio of science teachers to the students was 1:216 which was too much higher than the established ratio shown in the caption 4.2.1.5 Chapter 4. From this ratio it is evident that the school is manned by meagre number of science teachers in comparison to the real need.

Teaching Practices in the Classroom

The investigator stayed for one week in this school and observed nine periods of science. Among these periods, one was in physics, three were in chemistry and five were in bology.

During the stay with the school, not a single practical class was held there. It has been told by the science teachers that the practical periods are arranged at the end of school year for three months' period and those are meant for only the students of class X, who are going to appear at the S.S.C. Examination.

Due to the shortage of science teachers, the science subjects of class VI, VII and VIII were taught by teachers who had not studied science in their academic life.

The facts that came out of the observation of the science periods are detailed hereunder:

1. The science teachers were not seen in any periods with written lesson plan in the class. Later, they admitted that they generally do not prepare formal lesson plan in written form. But before science periods, they take preparation thoroughly and they go to the class with a plan in mind regarding the presentation of the lessons in the class. It has been known that the planning of activities of teaching science for a long term basis was not being followed in this school.

2. At the beginning of new chapters the teachers were found to make the class ready mentally by asking questions on the basis of previous less. But in other time the teachers did not take care of making the class ready mentally for the lesson by any device.

3. Objectives of lessons were not stated in the class in any form.

4. Lecture and blackboard-demonstration were the only methods of teaching in all the science periods. Sometimes the teachers were found to explain the important concepts and points with the help of black-board only. In some periods the teachers attempted to summarised the whole lesson by themselves towards the end of the period.

5. In the lower classes (VI to VIII) science was taught by non-science teachers. They were found to read the

text from the books, asking questions intermitantly to the students. Even they were rarely found to use blackboard in the class while teaching science.

6. In none of the periods, teaching-aids were used by the teachers. But the school had a good stock of aids like charts, diagrams, pictures, models, etc. These aids were found in the science laboratory in an uncared state on a table covered with dust.

7. The outcomes of the lessons were not found to be evaluated separately by the teachers in any periods. Rather, teaching and evaluation of outcomes went simultaneously.

8. Home-tasks were not found to be assigned in any periods by the teachers.

Organization of Extramural Activities for Strengthening of Science Education

It has been learnt that the school was not organizing extramural activities on science of any kind to strengthen science education.

Strategies for the Evaluation of Students' Achievements in Science

It has been reported that only two examinations are held in this school for the evaluation of students' performance.

These two examinations are known as half-yearly and annual. The portion of the textbooks of science taught during the first half of the school year was evaluated in the half-yearly examinations. On the other hand, annual examination is comprehensive by nature. What were taught in the whole year were evaluated in the annual examination.

The promotion of the students depends totally on the results of annual examination in this school. It has been reported by the headmaster that the students who fail to obtain minimum pass marks in annual examination get little sympathy for promotion to the next higher classes. In the case of selecting the students at the end of class X for S.S.C. Examination the school authority are very strict. In no case they consider a student for S.S.C. Examination if he fails in the major subjects.

It has been reported that essay, short answer and objective types of questions are used to evaluate the students' achievements in science. The results of both annual and half-yearly examinations are regularly shown to the parents of the students through progress report.

Attitude of Students towards Science

The mean attitude score in terms of 11 point psychological continuum was 3.85, for class VI, 2.96 for class VIII and 2.93 for class X. All these means indicate that attitude of the students towards science were favourable but moderate in class VI and high in classes VIII and X.

In order to know the pattern of development of attitude with the achievements in science subject, product-moment coefficient of correlation 'r' between the attitude scores and achievement scores in science of the students was computed for the whole class as well as for 'high' and 'low' achievement groups of students within each class. The computed 'r's have been shown in table 5.5 below.

Table 5.5 : Coefficient of Correlation Between Achievement Scores in science and Attitudes Scores, Schoole 'E'.

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.38 | -.33 | -.22 |
| VIII | -.41 | -.42 | -.25 |
| X | -.49* | -.81* | -.14 |

* Significant at .01 level.

The negative signs of 'r's here in table 5.5 indicate a positive relationship between achievement and attitude in science of all the cases vide explanation after table no.5.1.

The value of 'r' in the whole classes and in both high and low achievement groups of VI and VIII are not significant, indicating poor development of attitude with achievement. However, in class X and r is significant at .01 level in whole class as well as in high achievement group which depicts high development of attitude. On the other hand, in low achievement

group it is not significant which is indicative of very poor development of attitude.

Attitude of Science Teachers towards Teaching Profession

The attitude scores of four science teachers of this school were found to be 2.5, 2.9, 3.3 and 3.4 and their average is 3.0. On comparison of the average values with the neutral point '6' of the 11 point scale, it is evident that the science teachers of this school held moderately favourable attitude towards their teaching profession.

Exploration of Assistance and Cooperation from the External Agencies The he

The headmaster and the science teachers of this school were not well aware of the agencies and institutions, offering services and help to the schools for the improvement of science education in Bangladesh. The science teachers only mentioned the name of Bangladesh Audiovisual Education Centre and UNESCO. The school received teaching aids from Bangladesh Audiovisual Education Centre and some scientific apparatuses, chemicals and other materials long back from UNESCO.

Problems of Science Education

The shortage of science teachers is one of the acute problems for science teaching in this school. But it has been learnt from the headmaster that the root of this problem lay in the financial constraint of the school.

For the last five years the school could not replenish the laboratory with new apparatus, chemicals, specimens, etc., due to want of funds. Every year an amount of TK 2000.00 has been allocated in the annual school budgets for science education programme. But it was not available in full.

4.2.6. The Results of the Investigation in High Facility Schools

The science education practices of 5 'high' facility' schools have been reported in the succeeding section, according to the objective 2 of the study vide caption 1.5 of chapter. Here an attempt has been made to present some of the important feature regarding these schools on the basis of the information.

1. The nongovernment schools except one missionary school, were not able to recruit academically better qualified science graduates as teachers due to their financial constraint.

2. Three out of five including one government schools, had science teachers all trained.

3. Only a few teachers of high facility of schools, had inservice training in science teaching.

4. Admission of students to three schools including one government out of the five were competetive on merit basis and to other two were open.

5. Due to shortage of science teachers the average class-size in all the schools including the government one were higher than the optimum size.

6. The ratio of science teachers to the students were higher than the optimum ratio in all the schools in this category.

7. The teaching procedures in all these schools of this category except the missionary one, were of the same pattern whether the science teachers of the schools were trained or untrained. Lecture and blackboard demonstration were the dominant methods of classroom teaching in all the schools. But in the missionary school, other teaching methods were also in use, according to need of the contents.

8. The use of simple teaching aids in teaching science in the classroom were rare in these schools except in the missionary school. The missionary school was using the simple teaching aids of wall-chart type adequately.

9. The teachers of all the schools except the missionary one, did not prepare the lesson plan for daily classroom teaching and they also did not plan the science teaching activities either for short or long term basis. The lesson planning and the planning of science teaching activities in the missionary school was compulsory.

10. Three schools out of five of this category introduced term system in conducting the academic activities.

11. The science teachers of all the schools did not state objectives of the lessons before the class while teaching.

12. The practical works of the students were mechanical. The students simply imitate the procedures of the experiments as shown by the science teachers.

13. Inspite of being maximum facility schools, the available facilities for science teaching remained under-utilized except the missionary school.

14. The outdoor activities like field-trips, specimen collection work experience in field, etc. were not organized in the school adequately.

15. The science based extramural activities were not at all organized in two schools.

16. The science teaching in all the schools were highly examination centred which led the students to cram the content of science without proper understanding in order to get promotion to the next higher classes.

17. Three schools out of five use essay, short answer and objective types of questions and two other schools use only essay and short questions for evaluation of students' achievement.

18. The attitude of students towards science was favourable but low in class VI and moderate in classes VIII and X in the schools of this category in average.

19. The average* 'r' of each class of five 'high' facility schools showed favourable development of attitudes of students with science achievements in all the schools. But the magnitude of development were very poor in class VI, moderate in class VIII and comparatively high in class X.

20. The mean attitude scores of science teachers of this category of schools was 2.4 which indicates high favourable attitudes towards teaching profession with reference to the 11 point scale.

21. The library facilities for science education were not rich in these schools except in the missionary school.

22. Most of the schools were not aware of the institutions and agencies which offers services and assistance for the improvement of science education in the country.

23. All the schools had acute problems in conducting the science education programme and the roots of these problems lie in stringent finance except the missionary school.

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* The averaging 'r's were done by using Fishers 'Z' function. vide H.E. Garrett, and R.S. Woodworth. Statistics in Psychology and Education, Bombay: Vakils Ceffer and Simsons Ltd., 1979, p.173.

## 5.3. LOW FACILITY SCHOOLS

The study of five low facility schools with better results were conducted in the same manner as those of high facility schools which have already been mentioned in caption 5.2.3. above.

### 5.3.1. School 'F'

The school 'F' is a nongovernment girls' school in the rural area of Bogra district in Bangladesh. It was established in 1963 and is housed in a building. In the last three years about 93 percent of the students were passing in the S.S.C. Examinations in science.

#### Science Teachers and Their Recruitment

There were three B.Sc. Science teachers in the school. All of them had B.Ed. training. The average teaching experience of the science teachers of this school was 19 years. None of them had inservice training in science teaching.

The school has not any specific recruitment rule of its own. But it generally appoints science graduates as science teachers.

#### Admission Policy and Enrolment

Admission to this school is open for all girls students. The entry stage for admission is class VI. Admission of students to other classes depends on the vacancy of seats.

It has been known from the school records that 356 students were studying there. Class VI and VII had two sections and other three classes from VIII to X had no section. The average class-size then was 50.9 approximately which was high incomparison to the optimum class-size as shown in caption 4.2.1.5, vide Chapter 4. The ratio of science teachers to the students in the school was about 1:119. This ratio was also comparatively higher than the established ratio as pointed out in caption 4.2.1.5, vide Chapter 4. This fact indicates that the school was in shortage of science teachers.

Teaching Practices in the Classroom

The investigator observed seven science periods in this school. Among the seven periods, two were in physics, two were in chemistry and the three were in biology. All the five classes were covered in these observation. The investigator did not have a chance to see the practical class of science. The science teachers told that the practical classes are arranged only for the students of class X and generally held at the end of the school year. The important points of information that come out during observation of the science periods are presented below:

1. None of the science teachers were found with lesson plan in any of the periods. They, later, admitted that they do not prepare lesson plan in any form for teaching science in the classroom. However, they told that they take advance preparation for science periods

by reading textbooks. It has been reported that without prior preparation it is very difficult to teach science following the new textbooks particularly of class VI - VIII. Some new topics are there with which these teachers were not familiar in all the textbooks.

2. To begin with lessons in all periods, the teachers attempted to prepare the class mentally ready for the lesson, in some cases by simply asking questions from the previous lesson, in some cases from the environment and daily life of the students relating to the lesson.

3. The academic activities were conducted here in term system. The headmaster reported that the subject teachers prepare their scheme of teaching activities for each term at the beginning of the school session. The scheming of activities, as the investigator understood from the teachers were limited to the distribution of chapters of science textbook over the three terms.

4. The objectives of lessons were not found to be stated before the class in any form in any science period.

5. In all periods, lecture and blackboard-based demonstration were the methods of teachers in teaching. Questioning and discussions were used to explain and clarify only the important points, only when the teachers felt necessary. Questioning and discussion were teacher centred.

6. In none of the periods the teachers were seen to use teaching aids in any form. But while teaching, the teachers were drawing diagrams, pictures, etc., on the blackboard adequately for the students' understanding.

7. At the end of most of the periods the teachers evaluated the outcomes of the lesson by asking oral questions to the students.

8. In some periods the teachers assigned home-tasks in science to the students particularly to the lower classes (VI-VIII). It has been learnt that the teachers check home tasks regularly when assigned.

Organization of Extramural Activities for Strengthening of Science Education

The headmaster and the science teachers reported that they do not organize science based cocurricular activities in this school.

Strategies for Evaluation of Students' Achievement in Science

It has been mentioned above that the academic activities are conducted in term system in this school. It has been known that at the end of each term there is an examination for the evaluation of students achievements. Thus, achievements of the students in science are also evaluated by these terminal examinations. There are three terms in a year.

The promotion of students depends on the summated results of all the terminal examinations from one class to the next higher class. The results of all the terminal examinations are regularly shown to the parents of the students through progress reports.

It has been told that essay, short answer and objective types of questions were used in all the terminal examinations for the evaluation of science achievements.

Attitude of the Students towards Science

The mean attitude score of the students was 4.85 for class VI, 4.50 for class VIII and 3.74 for class X.

These mean scores of each of the above mentioned classes indicate that the attitude of the students toward science was favourable. But from the point of view of magnitudes of the mean scores, it is evident that the attitude of the students of class VI and VIII was low, while that of class X was moderate.

In order to know the pattern of development of attitude with the achievement in science product-moment coefficient of correlation 'r' between the science scores and the attitude scores was computed for each of whole classes and also 'high' and 'low achievement group within each class. The computed 'r's are shown in table 5.6.

Table 5.60 : Coefficient of Correlation between Science Achievement and Attitude Scores, School 'F'.

| Clas | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.32 | -.24 | -.03 |
| VIII | -.59* | -.54 | -.14 |
| X | -.77* | -.71* | -.43 |

* Significant at .01 level

The negative sign of 'r's of all cases as shown in table 5.62 above portray the positive relationship between science achievement and attitude of the students towards science vide explanation after table no.5.1b. However, the value of 'r's in whole class of VI as well as in high and low achievement groups were not significant which mean that the attitude of students were developing very poorly with the achievement in science.

On the other hand 'r' in the whole class of VIII was significant at .01 level but not significant for high and low achievement groups. These facts show that the development of attitude of the students towards science were developing substantially with the achievement in science in the whole class of VIII but it was poor in both high and low group.

The value of 'r's in the whole and high achievement group of class X were significant at .01 level but not significant for low achievement group. These indicate that the development of attitude of the students were developing highly in the whole class as well as in high achievement group and poorly in low achievement group with science achievements.

The Attitude of Science Teachers Towards Teaching Profession

The attitude scores of three science teachers were 1.9, 1.9 and 2.2 and their average was 2.0. Comparing the average value with the neutral point '6' of the 11 point scale it can be said that the science teachers of this school had high favourable attitude towards their teaching profession.

Library

The school had a small library with 175 books in all. But the books on science in the library were 15 only. These books were the science textbooks.

Exploration of Assistance and Cooperation from External Agencies

The school is in a remote rural area of the country and had little contact with the different institutions and agencies which are offering services and help for the improvement of science education in Bangladesh. The headmaster and

the science teachers, were unaware of the existence of those helping institutions and agencies which are in Dhaka city.

Problems of Science Education

The headmaster reported that before the independence, the school was self-sufficient pertaining to the science education. During the war of liberation the school building and all its belongings were damaged heavily. Furniture, apparatuses, equipments, library books were burnt. They had to start the school a new after independence. At present the school had problems in every aspect of science education. Finance, science laboratory, apparatuses, equipments, chemicals, teaching aids, books on science, etc., were inadequate in the school.

5.3.2. School 'G'

This is a nongovernment school in Dhaka city and came into being in 1968. The school is housed in a two storied building. During the last three years 99.3 percent of the students in average were passing in the S.S.C. examinations.

Science Teachers and Their Recruitment

The school had five B.Sc. science teachers. Only two of them had B.Ed. training. The average teaching experience of five science teachers was 5.2 years. None of them undertook inservice training in science teaching.

Although the school had not any specific rule for the appointment of science teachers, it generally appoints science graduate as a teacher of science. At the time of recruitment science graduates with better academic qualifications and good teaching experiences are closely considered for appointment in this school. Trained science graduates are rarely available for fresh appointment.

Admission Policy and Enrolment

The school is situated in the populus area of the city. Most of the parents residing near the school want their children to get admitted to it and this resulted in the admission to this school to be very much competitive. Thus, the school selects the children for admission through a written admission test. So, in the process of selection only bright children get admission to this school.

It has been known from the school record that 582 students were studying at the time of visit by the investigator to this school. Each of the classes consisted of two sections. The average class-size stood at 58.2 which was obviously higher than the optimum size as indicated in caption 4.2.1.5 vide Chapter 4. On the other hand, the ratio of science teachers to the students of this school was 1:116 approximately and was near the established ratio as shown in caption 4.2.1.5, vide Chapter 4. This indicates that the school was a bit short of science teachers.

Teaching Practices in the Classroom

The investigator at the time of his visit to this school observed eight science periods. Out of this periods, two were in physics, two were in chemistry and four were in biology. The investigator did not get any chance to see practical period of science.

It has been learnt that the practical works are provided only to the students of class X and these practical works are arranged towards the end of school year for a three month period. Practical works are held once in a week.

The important factst that emerged out of the observation of science periods regarding the teaching practices are presented below:

1. In none of the periods, the teachers were seen to use and come with written lesson plan in the classroom. In the subsequent interview with science teachers, it has been known that they generally do not prepare lesson plan formally for teaching science in the class room. But in some cases they make informal notes of important points of the lesson for teaching in the class. As the academic activities were conducted in term system, here, a tentative scheme of teaching activities were generally prepared on the basis of the chapters of science textbooks for each term in advance.

2. The trained teachers only attempted to make the class ready mentally for the lesson by simply asking a few questions linking with the lesson. But other teachers were not found to care about the mental preparation of the students for the lesson.

3. The objectives of the lesson were not stated in any periods by the teachers in any form. However, the teachers later, admitted that their ideas about objectives were not clear.

4. Lecture and blackboard-based demonstration were the frequently used methods of teaching science in each period. Discussions were sparsely used. Discussions were teacher centred and were used for the purpose of explaining necessary points of the lesson.

5. Use of teaching aids was absent in all periods. But in the laboratory a lot of teaching aids, collected from BAEC, were found.

6. In all periods the outcomes of the lesson were evaluated hurridely by asking oral questions only.

7. Home tasks were assigned only in the periods when the teaching of chapters of textbook was ended.

Organization of Extramural Activities for Strengthening Science Education

It has been reported that the school was organizing science exhibition every year. The students themselves

prepare their exhibits for the school science exhibition. During the last few years the students of this schools were participating in the National Science Exhibition. The school won the trophy twice for best exhibits. The school had a science club. The club arranges science excursion every year under the guidance of science teachers. It has been told that zoo, Baldha garden Science Miseum, Atomic Energy Centre, Bangladesh Council of Scientific and Industrial Research Laboratory etc. were the places of scientific interest for such excursions.

Strategies for Evaluating Students' Achievements in Science

It has been mentioned above that the academic activities are carried on in term system. Accordingly the achievements of students in science are also evaluated at the end of each term. There are three terms consisting of four months each. The promotion of students to next higher classes depends strictly on the summated results of each terminal examination. The results of each terminal examination along with the attendance and behaviour of the students are regularly shown to the parents of the students.

The science teachers reported that they were using essay, short answer and objective types of questions for the evaluation of students' achievements in science.

Besides these three terminal examinations, the science teachers reported to have arranged casual classroom test after the completion of teaching each chapter of the science textbooks.

Attitudes of the Students towards Science

The mean score of the attitude of the students was 4.64 for class VI, 3.53 for class VIII and 3.8 for class X.

The mean attitude scores of each class as are seen here show that the students were possessing favourable attitude towards science. But their magnitudes indicate low attitude in class VI and moderate in classes VIII and X in compare to the neutral point '6' of the scale.

On the other hand, to know the pattern of the development of attitude with science achievement, product-moment coefficient of correlation 'r's were calculated between science and attitude scores of the students. The results are shown in the table 5.71 below.

Table 5.71 : Coefficient of Correlation Between Science Achievement and Attitude Scores, School 'G'.

| Class | 'r' for the whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.31 | -.49 | -.31 |
| VIII | -.31 | -.43 | -.20 |
| X | -.48* | -.12 | -.04 |

* Significant at .01 level.

The negative sign of 'r's of all cases as in table 5.71 above dipicts positive relationship between science

achievement and attitude of the students towards science vide explanation after table no.5.1 ). However, the value of 'r's in all cases of class VI, VIII and X were insignificant except in the whole class of class X. Thus the development of attitude of students of all three classes i.e., in whole class as well as in high and low achievement groups were very poor with achievement in science except in the whole class of X. The 'r' in the whole class of class X was significant at .01 level which shows substantial development of attitude with achievement in science.

Attitude of Science Teachers Towards Teaching Profession

The attitude scores of five science teachers were found to be 2.7, 2.9, 3.1, 3.2 and 3.5 and the average was 3.1. On comparing the average value with the neutral point 6 of the 11 point scale it can be said that the science teachers of this school had moderate attitude towards their teaching profession.

Library

The school had a good library with about 5000 books. More than 300 books were in science. Science textbooks, science fiction, biography of renouned scientists of the world, etc., were included in them. Majority of the books on science were in English. It has been reported that the students of higher classes generally borrow books from the school library.

Exploration of Assistance and Cooperation from the External Agencies

It has been reported that the headmaster had contact with all the agencies and institutions which offer services and assistance to the schools for the improvement of science education in the country. He already explored their assistance and collected books on science, apparatuses, chemicals, biological models, specimens, slides, overhead projector, teaching aids, from those agencies. But most of them were not suitable for teaching science in school level of education except the teachings aids. Moreover, the science teachers were also not able to handle them as they were highly sophisticated in nature, and the teachers lacked training necessary for handling them.

Problems of Science Education

The most serious problem of science education in this school, according to the headmaster's version was the science teachers. The science teachers are available no doubt, but they do not stay in the school. They take up teaching for a stop-gap arrangement and remain hunting after better jobs. The science teachers of Dhaka city are almost commercial minded. They, in majority, indulge in private tuition and do not give proper attention to the works of the school or do it in a cursory manner.

The other problems are inadequate facilities for science teaching. And the roots of these problems lay in financial stringencies. The school was allocating TK 1500 per year in average for science education. This amount is not enought to carry on the whole year's curricular activities in science. To make both ends meet the school has no way out than to cut the practical works and other meaningful activities of science.

5.3.3. School 'H'

This is a government boys' high school in a sub-divisional town of Noakhali district. It was established in 1957. The school is housed in a two storied building. During the last three years 92 percent of the students were passing in the S.S.C. Examination in science in average.

Science Teachers and Their Recruitment

At the time of investigation there were three B.Sc. science teachers in the school. All of them had B.Ed. training and attended inservice training in science teaching comprising two weeks' duration. The average teaching experience of science teachers of this school was 16.3.years.

The recruitment procedure of science teachers of government school is same as mentioned under school 'A' above.

Admission Policy and Enrolment

The admission procedures of all the government school is the same and has been mentioned under school 'A' above.

The school records revealed that 450 students were studying in this school during the visit of the investigator. Each class had two sections, totalling 10 in the school. The average class-size then becomes 45 which is closely in conformity with the optimum size as mentioned in caption 4.2.1.5 vide chapter 4. On the other hand, the ratio of science teachers to the students was 1:150 in this school. This ratio was far away from the established ratio as shown in caption 4.2.1.5 vide chapter 4. Looking at the ratio, it can be said that the school sufferred from shortage of science teachers.

Teaching Practices in the Classroom

The investigator had observed eight science periods including one practical period during his visit to the school. Out of these eight periods, one was in physics, two were in chemistry, four were in biology and one practical period was on chemistry. The important facts that emerged out of the observation of science periods are put forth below:

1. The teachers were not seen to bring written lesson plan in any science period. However, they reported that they do not prepare formal lesson plan for class-room teaching. But they prepare brief note of important points of lesson when it is comparatively hard and new to them and to the class..

2. In all the science periods, the teachers attempted to introduce the lessons to the class by asking questions keeping link with the new lessons.

3. Objectives of the lessons were not stated before the class in any form. Later at the time of interview the teachers candidly admitted that their understanding and ideas regarding objectives were not clear though they all were trained.

4. Lecture, blackboard-based demonstration, questioning and expository discussions were the teachers' exclusive method in the classroom. The frequency of use of lecture and blackboard based demonstration were maximum in the class-room. Questions and discussions were teacher centred. The students were not participating in the discussion, even teachers were not encouraging the students to come forward with questions. During teaching, the teachers directly or indirectly were found to emphasise the student, to memorize what they had been teaching in the class.

5. Teaching aids were not used in any period. Though the investigator found many visual aids like models, charts, pictures, diagrams, etc., in the laboratory.

6. In some periods, the lessons were summarized by the teachers with the help of the students for their recapitulation. The teachers reported that this phase of making summary of the whole lesson at the end of the

periods, depended on the availability of time in the classroom.

7. The outcomes of the lesson were evaluated in majority of the periods in a shallow manner by asking a few perfunctory questions orally.

8. Home-works were assigned in all the periods to the students from the exercises of the textbooks. The teachers, later, reported that they examine the students' home-works carefully.

9. The practical works of the students were mechanical. First the teacher demonstrated the experiments step by step before the students with necessary explanation. The students would be then asked to do the same just following the procedures given by teacher.

It has been learnt from the science teachers that generally 15 experiments, 5 from each of physics, chemistry and biology are taught to the students. But in the syllabus, there is a mention of 60 experiments for the students of class IX and X in all.

The students of other classes have no entrance to the science laboratory. The practical works are only arranged for the students of class X only.

Organization of Extramural Activities for Strengthening of Science Education

The headmaster and the science teachers reported to have

organized science excursions and field trips to nearby places of scientific importance. Last year the students and the teachers visited a textile mill and Kaptai hydro-electric project. It has been known that science excursion was limited only to the students of class IX and X.

Strategies for Evaluation of Students' Achievements in Science

The school holds only two examinations in a school year for the evaluation of the achievements of the students'. These two examinations are half yearly and annual examinations. The promotion of students to the next higher class depends solely on the results of annual examination. Besides these two formal examinations the science teachers were taking monthly tests in science regularly in classroom in informal manner according to the report of the headmaster.

It has been learnt that essay, short answer and objective types of questions were used in evaluating students' achievement in science. The objective and short answer types questions were used in the lower classes (VI-VIII) and all three types in combination were used in higher classes (IX-X).

The results of both half yearly and annual examinations are recorded properly and are shown to the parents of the students regularly through progress reports.

Attitude of Students towards Science

The mean score of attitude of students was 4.94 for

class VI, 3.75 for class VIII and 3.66 for class X.

The average attitude scores of each class as are seen here indicate that the students were possessing favourable attitude towards science in all classes. But the numerical value of the mean score for class VI shows that the attitude was very low while those of classes VIII and X indicate moderate.

With a view to knowing the pattern of development of attitude with the achievement in science, product-moment coefficient of correlation 'r' between the attitude scores and science scores was computed for each of the whole classes and also 'high' and 'low' achievement groups within the classes. The value of 'r's are shown in table 5.8.

Table 5.8 : Coefficient of Correlation Between Science Achievement and Attitude Scores, School 'H'

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.44 | -.16 | -.05 |
| VIII | -.56* | -.77* | -.41 |
| X | -.57* | -.55 | -.53 |

*Significant at .01 level

The negative signs of the 'r's as are seen in the table 5.8 above in all cases, in fact, indicate a positive

relationship between the attitude of the students and science achievement vide explanation after table no.5.15.

The value of 'r' in the whole, high as well as in low achievement groups of class VI were not significant showing very poor development of attitude with science achievements.

On the other hand, 'r's in whole and high achievement group of class VIII were significant at .01 level and as such indicate comparatively higher attitude of the students in science with achievements. But 'r' in the low achievement group of the same class was not significant, showing poor development in attitude of students with science achievements.

Again, in class X the 'r' in the whole class was significant at .01 level which shows substantial development of attitude with achievement in Science, whereas the 'r's in both high and low achievement group of the same class were not significant which obviously indicate low development of attitude of the students with achievement in science.

Attitude of Science Teachers towards Teaching Profession

The attitude scores of three science teachers were found to be 1.9, 2.1, and 2.2 the average of which is approximately 2.1. Comparing this value with the neutral point '6' of the 11 point scale, it can be said that they had high favourable attitude towards their teaching profession.

Library

The school had a very good library with more than 3000 books of various disciplines. But the number of books on science was only 75. Mostly these were the biography of great scientists and old and new science textbooks. It has been reported that only a limited number of students from the higher classes regularly borrow the books from the school library.

Exploration of Assistance and Cooperation from External Agencies

The headmaster reported that he had close contact with the agencies and institutions which are offering services and help to the schools for the improvement of science education. The school already collected a bulk of its science apparatuses, chemicals, models, biological specimens, slides and wall-charts from UNESCO as gift. But, it is learnt from the science teachers that most of the materials of UNESCO, were not suitable for teaching sicence in school level of education.

The school also collected teaching aids from Bangladesh Audiovisual Education Centre and a few books from Asia foundation. The books on science got from Asia Foundation are in English language and are not useful for the students.

Problems of Science Education

Being a government school, it had a lot of problems concerning its science education programme. The headmaster

mentioned three acute problems that were affecting badly the science education of the school. These were inadequate quantity of science apparatuses, chemicals, and other allied materials, shortage of science teachers and funds to carry on the science teaching activities for the whole year.

The school was receiving TK 1200 annually for the science teaching as contingency grant from the Government. This amount was not adequate for the school for both the replenishment of the laboratory with the materials used up last year and to meet the expenditure of current year's incidental needs in carrying on the curricular activities of science. The purchase of adequate science apparatuses, equipments, chemicals, etc., and the appointment of science teachers in adequate number are beyond the jurisdiction of the headmaster. The consequences of these problems go to affect the quality of science teaching in the school.

5.3.4. School 'I'

This is nongovernment boys' school in the rural area of Rangpur district in Bangladesh. It was established in 1972. The school is housed in a brick-walled tin-shed. For the last three years 91.4 percent of the students of this school was passing in the S.S.C. Examination in science.

Science Teachers and Their Recruitment

There were three B.Sc. science teachers with 5.4 years teaching experience in the school at the time of the visit to the school by the investigator. Only one of them had B.Ed. training. None of the science teachers took inservice training in science teaching.

There was no recruitment rule for the appointment of science teachers in this school. However, the headmaster reported that they normally appoint science graduate as a science teacher here. He admitted that as a nongovernment school, they can not recruit academically better qualified science graduates due to their financial stringency. The science graduates with good academic qualification hardly come to nongovernment school where financial and other benefits are not lucrative.

Admission Policy and Enrolment

Admission of students to this school is open for all. The headmaster told that tuition fee is the main source of income of this school and in that score, the school accepts all the desirous students for admission here. The entry stage for admission is class VI. It has been known from the school records that 338 students were in the school and the average class-size was 67.6 without sections in any class. The class-size was obviously bigger than the optimum size as indicated in the caption 4.2.1.5. vide chapter 4. The ratio

of science teachers to the students was approximately 1:113 which was also higher than the established ratio shown in caption 4.2.1.5 vide chapter 4. This fact clearly indicates that the school was in shortage of science teachers.

Teaching Practices in the Classroom

The investigator observed six science periods covering all the classes from VI to X in this school. Out of the six periods, one were in physics, two were in chemistry and three were in biology. No practical period was observed here. It has been learnt that practical works are provided only to the students of class X. And the practical periods are arranged towards the end of the school year for three months. The science teachers reported that only a few experiments are taught to the students to prepare them for S.S.C.Examination.

The facts about the teaching practices that came out of the observation of classes are presented hereunder:

1. The teachers were not found in any period with lesson plan. They, later, told that they do not prepare lesson plan for science periods in written form. But they take preparation in advance by reading science textbooks before the periods.

2. The science teachers reported not to have planned the science teaching activities either for short term or long term. Rather, they decide tentatively the chapters to be taught before and after the half-yearly examinations.

3. The objectives of the lesson were not stated in the classes in any period. It has been revealed that they had little ideas about 'objectives' and their implications in teaching, at the time of interview.

4. In all periods the teachers used lecture and blackboard based demonstration for teaching in the classroom. Questioning and discussion were used along with lecturing intermittently. In questioning and discussions the students were not involved.

5. Teaching aids were not used in any of the periods.

6. Towards the end of the periods, the outcomes of the lesson were evaluated hurridly by asking oral questions only.

7. The home-works were assigned in all periods.

Organization of Extramural Activities for Strengthening Science Education

The headmaster and the science teachers reported that they do not organize any cocurricular activities basing on science in the school.

Strategies for Evaluation of Students' Achievement in Science

It has been reported that only two examinations are held in the school in a year for the evaluation of students' achievements. These are half-yearly and annual examinations.

The achievements of the students in science are also evaluated by these two examinations. Out of these two, annual examination is very important to the students. However, the promotion of the students from one class to the next higher class depends solely on its results. The results of both the examinations, of course, are shown regularly to the parents of the students through progress reports. Besides these two formal examinations, the science teachers told to have arranged informal classroom tests often for students' appraisals.

It has been known that the teachers generally use essay and short answers types questions only, while evaluating the students' achievements in science in those examinations.

Attitude of the Students Towards Science

The mean attitude score of students was found to be 4.68 for class VI, 3.81 for class VIII and 2.94 for class X in terms of 11 point scale. From these mean scores it can be said taht the attitude of the students towards science was favourable. But comparing these means with neutral point '6' of the scale, it is evident that the students of class VI had low, class VIII had moderate and class X had comparatively high attitude towards science. In order to know the pattern of development of attitude of the students with achievements in science, product-moment coefficients of correlation 'r' was calculated between the science achievement scores and attitudes

for all three classes. The calculated values of 'r's are shown in table 5.9.

Table 4.9 : Coefficient of Correlation between Science Achievement and Attitude Scores, School 'I'

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.45 | -.60 | -.34 |
| VIII | -.59* | -.24 | -.14 |
| X | -.59* | -.61 | -.33 |

* Significant at .01 level.

The negative sign of 'r's in table 4.9 above in all cases, as a matter of fact, indicates a positive relationship between the attitude of the students towards science and achievement in science in this school vide explanation after table no.5.1.

The value of 'r's in all cases are not significant except for the whole classes of VIII and X. All these facts indicate poor development of attitude of the students except in the whole class of VII and X. The attitude of students in the whole class of VIII and X are developing high with the achievement in science.

## The Attitude of Science Teachers Towards Teaching Profession

The attitude scores of three science teachers were 3.3, 3.6 and 4.2 and their average was 3.7. This average value indicates that the science teachers of the school were having favourable moderate attitude towards their profession in comparison to the neutral point '6' of the 11 point scale.

## Library

The school had a small library with about 350 books in total. Books on science were few in number.

## Exploration of Assistance and Cooperation from External Agencies

The headmaster and the science teachers were not aware of the institutions and agencies that are offering services and assistance to the schools for the improvement of science education in the country. They took the names and addresses of those institutions and agencies from the investigator and would explore their services and assistance.

## Problems of Science Education

It has been reported that the main income of the school is tuition fees from the students and government grants. Major part of the income of the school goes for the payment of the salaries of the teachers. The school had many problems

concerning its science education programme. The solutions of these problems involve huge finance. The school was not in a position to afford it. However, the major problems mentioned by the headmaster and the science teachers were science laboratory, apparatuses, chemicals, teaching aids, books on science and funds to maintain the science teaching activities in the school.

5.3.5. School 'J'

School 'J' is a nongovernment boys' institution in a suburban area of Dhaka city. It was established in 1975. The school is housed in a bamboo-fenced tin-shed. During the last three years about 96 percent of the students in average were passing in the S.S.C. Examination in science.

Science Teachers and Their Recruitment

There were five B.Sc. science teachers in the school. None of them had B.Ed. training. The average teaching experience of the five science teachers was 3.4 years. Only two science teachers took inservice training in science teaching.

The school has no specific recruitment rule for appointment of science teachers. The headmaster, however, reported that they were generally appointing science graduates as science teachers here. Science graduates with good academic qualifications are available but they do not stay in the school.

They take teaching profession as a stop-gap arrangement and remain hunting after jobs elsewhere and leave school when they get good jobs.

Admission Policy and Enrolment

The admission of students to this school is highly competitive. The students are selected by a written test. The entry stage for admission is class VI. Students are also admitted into the other classes if the seats fall vacant. Tuition fees to this school is comparatively higher than the other similar types of schools in Dhaka. Therefore, students from higher economic group are coming to this school for education.

It has been known from the school record that 600 students were studying in the school. Each of the classes had two sections. The average class-size were 60 which was bigger than the optimum size indicated in caption 4.2.1.5 vide chapter 4. The ratio of science teachers to the students of the school was 1:120. This ratio was also higher than the established ratio, mentioned in caption, 4.2.1.5 vide chapter 4. It clearly shows the shortage of science teachers in the school.

Teaching Practices in the Classroom

The investigator observed five science periods covering all classes from VI to X during his visit to the school.

Out of the five periods, one was in physics, two were in chemistry and two were in biology. No practical period in science was seen in this school. Because the practical works are generally held towards the end of the school year for three months. And the practical works are arranged only for the students of class X in order to prepare them for the S.S.C. Examination. Only limited number of experiments are taught to them for this purpose.

The facts about the teaching practices that emerged out of the observation of science periods are described below:

1. The teachers were not found with lesson plan in any of the science periods. In a subsequent interview with them, it has been learnt that they do not prepare daily lesson plan for science teachin in written form. But they mentioned that they take preparation regularly for the science lesson by reading textbooks only.

2. It has been reported that the academic activities are conducted by term systems. The school year consisted of three terms. The span of each term is four months. The science courses, like other subjects are distributed over the three terms on the basis of the chapters of science textbooks. The science teachers teach those chapters of science textbooks that fall in a particular term within the scheduled time.

3. The objectives of the lessons were not stated before the class in any period.

4. Lecture and blackboard-based-demonstration were the dominant methods of teaching in the classroom. Discussions and questioning were used sparsely along with lecture and demonstration. Discussions and questioning were teacher centered. The students' participation was not encouraged by the teachers in discussion.

5. Teaching aids relating to the lesson were not found to be used by the teachers in any period. Improvised teaching aids could have been used in the classroom while teaching.

6. The teachers were seen to evaluate the outcome of each lesson by oral questions only in the classroom.

7. Homeworks were assigned to students in each periods. Later teachers admitted that they do not check the homework always.

Organization of Extramural Activities for Strengthening of Science Education

It has been mentioned by the headmaster and the science teachers that they arrange field trips to the nearby places of scientific interests regularly. Last year the students under the guidance of science teachers visited the zoo.

National garden, Boldha garden, Science Museum and BCSIR*. Besides the above mentioned activities, the school does not organize other types of cocurricular activities here.

Strategies for Evaluation of Students' Achievements in Science

It has been mentioned that the curricular activities in the school are conducted in term system. Accordingly, the school arranges examination at the end of each term in order to evaluate students' achievements.

The promotion of students depends strictly on the summated marks of all the three examinations held in each term. The results of all terminal examinations of the students are shown to the parents regularly through progress reports.

Besides these three formal examinations, the science teachers reported to have arranged tests in science regularly after the completion of teaching each chapter of science textbooks in the classroom.

It has been known that essay, short answer and objective types of questions are jointly used in the above mentioned examinations for the evaluation of achievements of the students in science.

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* Bangladesh Council of Scientific and Industrial Research.

Attitude of the Students Towards Science

The mean attitude score of students of each class in terms of 11 points scale had been 5.40 for class VI, 4.66 for class VIII and 4.06 for class X. The mean scores as are seen here indicate that the attitude of the students towards science was favourable. But the question is to what extent favourable. Considering the magnitudes of the means it is evident that the attitudes of the students of class VI were very low and those of class VIII and X were quite low in reference to the neutral point '6' of the 11 point scale.

However, in order to know the mode of development of attitude with achievements in science, product-moment coefficient of correlation 'r' between attitude scores and science scores of the students for each of the whole classes and also in 'high' and 'low' achievement level in all classes was computed. The 'r's are shown in the table 5.10.

Table 5.10 : Coefficient of Correlation between Science Achievement and Attitude Scores, School 'J'

| Class | 'r' for whole class | 'r' for | |
|---|---|---|---|
| | | High achievement group | Low achievement group |
| VI | -.20 | -.30 | -.19 |
| VIII | -.23 | -.38 | -.32 |
| X | -.53* | -.44 | -.48 |

* Significant at .01 level.

The negative sign as are seen in the correlations in table 5.10 above in all cases indicate, in fact, a positive relationship between the attitude of the students and science achievements vide explanation after the table 5.10.

The value of 'r's in all three classes, were insignificant in whole classes as well as in both high and low achievement groups of each respective class except in the whole class of class X, where 'r' was significant at .01 level. All these facts indicate that the development of attitude with achievement in science in all the cases were very poor whereas in the whole class of X, it was substantial.

Attitude of Science Teachers Towards Teaching Profession

The attitude scores of five science teachers of the school were 2.8, 2.9, 3.0, 3.7 and 4.3 and average of these was 3.3. Comparing this average value with the neutral point '6' of the 11 point scale, it becomes evident that the teachers of this school had favourable moderate attitudes towards teaching profession.

Library

The school had 250 books in its library. It has been reported that the number of books on science was only 15 and these were only textbooks on science.

Exploration of Assistance and Cooperation from External Agencies

The school is in Dhaka city and the institutions and agencies that are rendering services and help to the schools of the country for the improvement of science education are all situated in Dhaka. It has been known that the headmaster had already contacted many of the institutions and agencies for help and cooperation for the science education programme of the school. The headmaster reported that he already had received science books from Asia Foundation. But these books are not suitable for the school students.

Problems of Science Education

This is a new school and as such had many problems as narrated by the headmaster of the school. Among the problems, school building, science laboratory and adequate laboratory materials were the important problems of science education in this school. The scarcity of science teachers is another problem in a sense that they do not continue in this profession.

The Results of Investigation of Low Facility Schools

The information regarding the practices of science education and other aspects pertaining to the 5 'low facility' schools have been reported in the succeeding sections. Here an attempt has been made to present some important results on the basis of the information.

1. Due to the acute financial stringency and/or scarcity of the science graduates, the schools of this category were generally not able to recruit academically better qualified science teachers.

2. Two out of the five schools here had their science teachers all trained.

3. Only a few science teachers had inservice training in science teaching.

4. Admission of students to three schools out of the five in this category was competitive on merit basis and to other two it was open.

5. Due to shortage of science teachers in these schools, the average class-size was much higher than the optimum size.

6. The ratio of science teachers to the students was very much higher than the optimum ratio.

7. The teaching practices in all the schools of this category were of the same pattern whether the science teachers of the schools were trained or untrained. Lecture and blackboard-based-demonstration were the dominant methods of classroom teaching. Questioning and discussion were infrequent in the classroom.

8. The teaching aids were not in use in general in the class-room for teaching science in three school.

9. The teachers of all the schools in this category did not prepare lesson plan for daily classroom teaching. Even the planning of science teaching activities on long term or short term basis was not in practice in these schools.

10. Three schools out of the five of this group were conducting the academic activities in 'term' system.

11. The science teachers of all these schools did not state the objectives of the lesson before the classes while teaching science.

12. Most of the science teachers in this category of schools did not have clear ideas about the 'objectives' and their implications in teaching.

13. Practical works were mechanical. The students simply were imitating the procedures of the experiments as shown by the teachers.

14. Science teaching activities were limited only within the classrooms. Outdoor activities were rare.

15. Inspite of being low facility schools, the science teachers were not using the low-cost materials for improvising them either by themselves or with the cooperation of the students to make up the deficiencies of the facilities.

16. Science based extramural activities were not organized adequately for strengthening the science education in these schools.

17. The science teaching in all the schools were highly examination centered.

18. Three out of five schools were using essay, short answer and objective types questions for the evaluation of students' achievements in science. The other two schools were using only essay and short answer types questions.

19. The attitude of the students towards science was favourable, but the development of attitude was very poor in class Vi and VIII and low in class X by and large.

20. The average 'r'* of each class of five 'low' facility schools showed that the development of attitude with achievement in Science were very poor in class VI, VIII and high in class X.

21. The attitude of science teachers towards teaching profession was favourable and high as was indicated by the mean score 2.9 of teachers of these schools with reference to the 11 point scale.

22. The library of all these schools had very poor collections of books on science.

23. Majority of the schools were not able to explore and exploit the services and assistance of the institutions and agencies working in the country for the improvement of science education.

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* The average 'r' was calculated by using Fisher's Z function.

24. All the schools of this category had acute financial stringency which was the root of other problems of science education.