

Present situation of science education in secondary schools

Background of the study

Science and Technology have shown a spectacular growth during last few decades. The progress has outstripped all expectations. For any country to maintain the position of strength in the world affairs to-day, and to continue its internal growth and development satisfactory, it is almost essential to ensure that satisfactory standards are maintained in science education. So science educators throughout the world have begun to make radical change in the Science curricula. First, objectives were clearly changed. The focus of the curriculum was not only the science content but also towards the acquisition by students of 'Scientific' skills and attitude and towards their understanding of how the discipline 'works'.

Bangladesh is a new born emergent nation. Immediately after her independence the then govt. felt the necessity to improve the condition of the existing education system. The Bangladesh Education Commission (1973), and Curriculum and Syllabus Committee (1975) were formed. Both has given more importance and stress to science education at school level to help students to develop scientific sprite, Knowledge, and skill to improve the quality of life and raise the standard of living, both individually and collectively.

The nation has passed 41 years plus. During this time several Education commissions, curriculum committees were formed. All those commissions and committees continued the stress to enhancing the school science education. As the process of continuation, present government has taken different steps for development of education system with the firm impression to build the Digital Bangladesh. For this to occur we need and expect high enrolment of school students in Science. But in practice it is not happening. In reality the enrollment of science is low and decreasing day by day.

Now the questions are: Why enrollment of Science is low? Why the rate is not increasing? Is not the Curriculum enabling to create interest to the Students towards Science learning? Is not it interesting, or Teachers are fail to make it attractive? Are not the teachers qualified with proper Knowledge, skill and attitude of teaching science? Or they are not well equipped? What is the weakness, threat? Or is there any strength or opportunity?

To find out the answer to those questions, an extensive investigation about the present situation of science education in secondary level is necessary. Such investigation may result with the basic information to give answer to the above questions.

Rationale of the study

At national level we have three types of schooling systems. Those are General Education, Madrasah Education and Vocational Education System. In all system of Secondary level we have three steams viz. Science Group, Humanities Group and Business education group. If we compare the student's enrollment group wise, we will find that the rate of Science group's

enrollment is decreasing year by year. (2011 to 2013), in Madrasah it has changed from 44% to 37% in Rural non Govt. Schools 23% to 17% and govt. school 94% to 75% respectively (Roy, 1913)

SSC results of BISEs also show similar down fall of science group students. For increasing the science enrollment vis-à-vis developing pupil's interest in Science a good number of projects were taken by the Ministry of Education. Out of those SESDP, SEDP, FSSAP, TQI etc are trying to develop science curriculum, text materials, teaching materials, Science teachers and developing the physical facilities of science learning by supplying chemical, equipments even erecting well equipped science buildings. But why this down fall still persisting? What are the real situation of teaching science, what are the weakness and threat? Has not been created there any strength and opportunities in favour of learning science due to the effort of last decades? A special type of SWOT analysis is to days demand for finding the way for developing the present situation of Science education of the school level of Bangladesh. In 2009 students appeared in science group were 182744 (22.9%) out of total students 797891 in SSC examination of eight boards. Similarly these percentages were 22.4%, 21.9%, 22.6%, and 22.9% in 2010, 2011, 2012 and 2013 respectively. What can we conclude from this output statistics? All these questions lead to find out the situation of Science education in secondary level of Bangladesh.

Statement of the problem

The study has been designed for focusing the present situation of the science education i.e. to identify the Strength, weakness, threat and opportunities of teaching learning situation in schools and madrasahs of Bangladesh including to look for the causes of low enrollment in science group and to reach at a suitable recommendation for the education planners. Hence the study "Present situation of Science Education in the Secondary level of Bangladesh" is timely and relevant.

Objectives of the study

Main objective of the study is to find out the present situation, in terms of strength, weakness, opportunities and threat of science Education in secondary level schools of Bangladesh. To realize these main objectives it has spelled out as the following specific objectives:

- a) To verify the Suitability of curriculum and text materials in terms of fulfillment of users need.
- b) To find out the existing facilities of Schools for executing Science teaching. (Viz. Class room, Laboratory, science equipments, Chemicals and apparatus, Budget, management, Human resources.)

- c) To verify Teaching strategies used in classrooms and science Culture practice in schools. (Viz. time schedule, class routine teacher preparation, student participation, cultural activities.)
- d) To determined the Attitude of Teachers and students towards Science, scientific literacy and causes behind decreasing rate of Science group enrollment in Secondary education.

Delimitation of the study

The study will be delimited to the present secondary Govt. and non govt. schools and Dakhil madrasahs of Bangladesh.

Methodology

A. Population and Sample

Source of data for this study were of three types: (1) documents, all the present curriculum, syllabus, text materials used by the teachers and students, (2) all secondary level educational institutes i.e., all the government, non government secondary schools and Madrasahs and (3) all personals concerned with teaching and learning of Science in secondary level viz., the head master/supers, science teachers and students, guardians, local educational administrators and experts.

Total 100 secondary educational institutes (74 Schools and 26 Madrasah) were selected from 15 upazila of 7 divisions of the country. Selection was made maintaining the population ratio of institutes and considering govt.-non govt. rural-urban, boys-girls ratio. Then 100 heads, 100 classes, 100 science teacher, 100 guardians of the concern institute. 10 science education specialists, 15 upazila secondary education officer (USEO), 300 students of class IX – X and 240 student of Class VIII were selected as data source.

B. Tools

Ten types of research instruments or tools were used for collecting data for this research purpose. Those were:

1. Inquiry Sheet for the Educational institute and its Head.
2. An interview schedule for the head of the Secondary level Institute.
3. A Science Class Observation Schedule.
4. An interview schedule for the Teacher teaching Science in a Secondary level Institute.
5. An opinionnaire or attitude scale for the Teacher teaching Science in a Secondary level
6. A FGD Guide line Sheet
7. Questionnaire for Students of grade IX-X.
8. An Interview Schedule for Guardians

9. Questionnaire for Upazila Secondary Education Officers /Sc. Education Experts.
10. Laboratory information check list

All these Tools were developed by the research team after reviewing the Curriculum, Syllabus, Science Textbooks, Pedagogical texts, some research in the similar area and experienced persons. After preparation all these have been vetted by a Headmaster, an Asst. Headmaster and a senior teacher all with Science background and teaching Science in Secondary Schools. After necessary correction and alteration as suggested through vetting Tools were finalized and printed after getting approval of the BANBEIS.

C. Method of Data Collection

Research team have directly visited the selected educational institute and collected data personally through interview, observation, FGD and administering questionnaire as required.

D. Data analysis

Collected data analysis is done objective-wise to find out the relationship of data and the objectives. Proper descriptive Statistical methods utilized by using SPSS. Percentile value, mean, weighted average and t-test have been employed accordingly.

Major findings of the Study

Findings of the study are presented objective wise in the following sections.

Findings related to objective 1

1. Very few head of and science teachers of schools and madrasahs have read the curriculum report 2012. According to those who have gone through it the curriculum is timely and good one.
2. Strengths of the curriculum are: it has given importance on learners ability and maturity, it is fit for learning through doing, scientific attitude for making science interesting, positive attitude towards the elements of environment, Participatory teaching-learning approach and logical arrangement of knowledge.
3. Weaknesses of the curriculum are: Difficult to implement in rural level and No application of scientific knowledge for preparing science minded nation.
4. Text books are to some extent suitable for fulfill the need of teachers and learners. But some contents are not clear and some are incomplete, some unknown terminology and shortcomings have marked in Chemistry and Physics chapters by the teachers.

5. According to Students, their textbook is fine, it includes sufficient illustration, the language is easy to understand. Student liked the activities and experiments presented and works assigned to them in textbook. But they are sorry to express that teachers do not follow the books according to the book.
6. Strengths of the text books are : The textbook is full of satisfactory illustrations The Bulk of book is small and its contents less chapters, easily comprehensible learning outcomes have stated clearly at the beginning of Chapter and, Includes activities, inquires and experiments
7. Weaknesses of the text book are: Some contents are not clear or has not been explained clearly. Some important basic contents are omitted, no glossary at the end of the chapter, and there are mistakes in some illustrations, spelling and information/facts.

Findings related to objective 2

1. On average about 15% schools and 31% madrasahs have no science laboratory (though there is a small store of a little amount of equipment in a self or in a drawer of head master's / principal's room or in teacher's room).
2. 13.5% rural and 20.3% urban high schools and 23.1% and 13.6% urban madrasahs purchase equipments regularly.
3. More than 50% schools and Madrasahs have no provision for annual budget for laboratory fund.
4. About one third institutes purchase equipment occasionally. But other two third never purchase laboratory equipments.
5. 35.1% rural and 36.5% urban high schools and 42.3% rural and 15.4% urban madrasahs maintain, laboratory stock register (but no institute could a show it in practice).
6. 28.4% rural and 43.2% urban high schools and 19.2% and 7.7% urban madrasahs have proper laboratory maintaining.
7. Only 69.9 % schools and 50% madrasahs have different types of (single roomed, two separate roomed or three separate roomed) laboratories.
8. Over all 32.9%, 48.6%, 27.5%, 22.9%, 22.9%, 32.8%, laboratories are sufficient or up to the standard with respect to size, number of windows, selves/cupboards, number of chemical items, number of apparatus and equipments, sitting arrangement (table, chair, tools).
9. 12.2%, 34.9%, 34.5% laboratory has gas, water and electricity supply respectively. 28.6% laboratory has first aid box.

10. There are 8 science teachers per govt. schools, 3.6 science teachers per non govt. urban schools, 3.1 per non govt. rural schools, 2.7 per urban madrasah and 2.3 per rural madrasah including mathematics teacher.
11. Average percentage of Science-Math teacher only 21.9 and 15.6 percent of total teachers in school and madrasah respectively. This means that there are 3 science- math teachers per every 20 teachers.
12. Qualified graduate trained (B.Sc., B.Ed./M. Ed) teachers are 41.7%, 25.0%, 50%, 4.2% and 28.6% in Govt. schools, non govt. urban and rural schools, non govt. urban and rural madrasahs respectively.
13. The highly educated post graduate trained (M.Sc. B.Ed./M.Ed.) teachers are 44.7%, 60% and 10.3% in Govt. schools, non govt. urban and rural schools respectively
14. 14.6% teachers in School and 54.2% teachers in madrasah (Average 24.1% teachers) are simply science graduate.
15. Teachers of physical science and biological science are not sufficient in school or in madrasah. Pure physical science teachers are only 29.7% in schools and 19.2% in madrasahs. And pure biological science teachers are 46.0% in schools and 34.53% in madrasahs.
16. About 3% in school and 23% in madrasah teaching science without science back ground are not at all competent for teaching science. (Their back ground is Arts or religion base).
17. 8.1% urban, 10.4% rural school teachers' ; 25% urban and 14.3 % rural madrasah science teachers' class load is very high (more than 30 per week). 43.2% urban, 32.4% rural school science teachers'; 50.0% urban, 40.9% rural madrasah science teachers' class load is high enough (26-30 period per week). So more than 26 class load per week is common for all institutions.
18. Science teachers are loaded by other than science class.
19. Science Co-curricular activities are almost absent in madrasah, very occasional in rural school, and a little in urban schools.
20. Heads and science teachers of the schools and madrasahs opined that science culture is important for advancement of Science Education, but due to some essential hindrance like financial hardship (13%), non-existence of laboratory and equipments (9%) and absence of initiation (4%) it is not possible to continue these activities.
21. 24.2% Head- masters of secondary schools teaching Science subjects. But in case of madrasah none is teaching science.

Findings related to objective 3

1. Only average 32.4% urban schools, 43.2% rural schools and 7.1% rural madrasah are following the direction given in curriculum. Still class duration varies from 35 -40 minutes in majority institutions, especially 95% in case of madrasahs.
2. 50% institute follows curriculum instruction of 4 periods of 50 minutes per week for instruction of Science in classes VI to X. Other 50% giving instruction for 3 periods of 35-40 minutes per week.
3. 100% science agreed that they need extra preparation for giving lesson, 98% agreed they need lesson plan to teach but they do not practice these due to scarcity of time.
4. 86% Science teachers help the administration to prepare yearly class routine.
5. For class room instruction Science teachers mostly use Lecture method (55.4% in school, 77.3% in madrasah); reading method (75.7% in school, 81% in madrasah);
6. 100% science teachers of school and madrasah encourage students to study in science group in IX-X class.
7. Science teachers do not follow activity and participatory approach of teaching-learning strategies while give instruction in class. Do not help student to practice group discussion group or individual work, activity, experiments.
8. According to teacher problems of teaching science through activities are: Scarcity of equipments and Lab (20%), short class length, high work load and less period per week (3%).
9. For studying a few fundamental concepts 34.2 % school teachers and 18.2% madrasah teachers provided sufficient emphasis to promote scientific literacy. Also 25% school teachers and 18.2% madrasah teacher provided sufficient emphasis to present content based on pupils past experiences.
10. Around 39.5% school teachers did not give emphasis on assessing understanding and its' application to new situations.
11. Around 45.5% madrasah teachers did not give emphasis on assessing understanding and its' application to new situations, 22.7% on to help learning Science actively by using multiple source of knowledge/information (internet, media etc.) and on open discussion that investigate relevant science questions.
12. The science teachers in secondary schools and madrasah do not give emphasis much in promoting scientific literacy. Teachers give less emphasis to achieve the purpose of science in secondary schools.
13. Schools and madrasah teachers have positive attitude towards science teaching. Moreover, they have the more self esteem and outcome expectancy about science teaching. And both types of teachers have the similar attitude and belief about their science teaching.
14. 33% science teacher belief that "This is age of science and technology, personal and national development is not possible without Science, so everyone should have basic knowledge of Science".

Findings related to objectives 4

1. Science student enrolled in class IX and X in govt. school is highest in all groups but it is lowest in non Govt. School and Madrasah.
2. Enrollment of Science group has decreased from X to IX (for 2012-13). But it has increased for other groups.
3. Reasons for choosing subject other than Science by the students are mostly: subject is easy, related to their career plan and educational expenses are less.
4. Major cause of students avoiding science is that they are weak in Math and Science subject, Science is not interesting to them rather hard, beside these other causes are scarcity of Science teachers and relatively high expenses of education.
5. Causes of students choosing science are better comprehensible that is Science is easy and interesting to them and they are curious and ambitious of science oriented career (e.g., engineering, Medicine, Research etc.).
6. Few students depends on their teachers for their career selection. It is clear that teachers are not able to create any good image of confidence to pupils mind.
7. 44.8% rural, 41.7% urban school guardians and 25% Madrasah guardians think Science is for meritorious and studious learners only.
8. 27.3% rural, 50% urban school guardians and 50% rural 75% urban madrasah guardians think student should not select science that are weak in science and math. 37.9% rural, 20.8.7% urban school guardians and 50% Madrasah guardians think science study is costly.
9. USEOs seems that the causes of not choosing science are mostly the scarcity of science teachers (60%), comparatively large syllabus (33.3%), much educational expenses (33.3%) and scarcity of scientific apparatus, equipment and chemicals (20%).
10. According to education specialists case of students disinterest in science are absence of interesting classroom teaching, lack of qualified, trained and motivated science teachers, lack of favorable infrastructure of teaching-learning environment of Science and there is no strategy of "learning by doing" in school.
11. Future effect of students low enrolment in science are: Nation will fall back in agriculture, industry, technology, communication, research etc.
12. National dependency on other nation will increase day by day.
13. It will hinder the expansion of Knowledge, creativity, scientific attitude of citizen.

14. Science learning is process learning, in absence of Science learning there will be no process learning. So development of creativity, development of problem solving skill will be hindered.
15. Teachers face problem to teach science in class due to scarcity of equipments and laboratory (20%), Unable to perform the activities and some contents are not clear to teachers.
16. Teachers opined that supply of required equipments (11%); need based teacher's training (8%) and more elaborate and explanatory textbooks (6%) would be required to perform expected class room teaching,

Recommendations

1. Immediate steps should be taken to further develop and fill the lacuna of Curriculum syllabus and text materials. The gap between School and Madrasah curriculum should be eliminated as earlier as possible.
2. Textbooks should be reviewed and necessary correction should be done in every year as routine.
3. Teachers and students have suggested adding some texts in the book as follows:
 - a. Chemistry : Structure of matter, symbol, formula and valence (15)
 - b. Matter: explanation of element and compound
 - c. Character of chemical equation cause and classification
 - d. Light: explanation on how mirage formed
4. Sufficient number of science teachers should be appointed to reduce the Class load of Science teachers.
5. Higher pay scale and promotion system to feeder post should be introduced to attract scholars to teaching in general and for science particularly.
6. Science teachers should not be loaded with other than science subject and non science teachers should not be employed to teach science.
7. An annual budget for laboratory should be mandatory.
8. Separate post of Physical Science (physics, Chemistry), Biological (botany and zoology) and mathematics teacher should be created.
9. Post of Lab assistant and skilled laboratory bearer should be created.
10. Laboratory should be mandatory for every secondary (for VI –X grade) school and madrasah. 'One day per week' for science lab work should introduced for ensuring activity base science teaching in class routine from VI to X with 25% weight age of curriculum for students, with mandatory practical examination in every stage (e.g., terminal, half-yearly and annual examination).

11. All laboratories should have standard physical facility with required equipments and chemicals.
12. Science co- curricular activity should be mandatory for every School. One week for annual science fair, "Annual School/Madrasah Science Week" should be announced /allotted by the authority nationwide.
13. 50 minutes class, and 4 periods per week should be ensured in class teaching in every school and madrasah.
14. Reading, lecture and traditional cook book type method of teaching should be replaced by investigatory teaching approach immediately.
15. Steps should be taken to increase student's enrollment in science and find the ways to accelerate growth.
16. To employ qualified trained sufficient number of subject base Science teachers in secondary level. Provision for employing sufficient subject-base teachers should be created.
17. Initiatives should be taken to draw intelligent scholar to school teaching, make students interested towards science
18. Different and attractive pay scale, create promotional probation, and incentive for science teachers should be offered.
19. Develop standard infrastructure (with science apparatus, Equipments and chemicals) for science teaching in every schools and madrasahs should be provided.
20. Nationwide awareness and motivational program to promote Science education should be organize and mass media for publicity regarding science education Should be employed.

Recommendations for further Research

1. Research should be conducted to find out the ways to make the SSC and Dakhil Science Curriculum equivalent.
2. Research should be done to standardized school laboratory for the requirement of curriculum need.
3. Investigation should be done to find out the ways of introducing investigatory science teaching.
4. Investigation should be done to find out the ways of increasing enrollment in secondary level science stream.

5. Investigation should be done to find the ways of implementation of activity base science education.
6. An extensive study should be done to find the causes and remedy of teachers' apathy for teaching Science.
7. Study on curriculum evaluation should be done immediately.
8. An investigation should be done on "Why teachers are still following traditional method for Science teaching in secondary level."

Epilogue

Without proper implementation of science education national development is far to reach rather impossible. So, all steps regarding its improvement are important. Suggestions of this research would be very usefull. It is researchers hope and desire that the nation will make its place in the world of creative and scientific intellectuals by developing its secondary science education soon. All efforts need to be diverted to plan and develop Science education at all levels of education in the country.