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Implementation of Grade 8 Science Curriculum 2012 in Bangladesh: Challenges and Way Forward

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Abstract

This paper identifies the challenges encountered by the Science teachers in implementing Science Curriculum 2012 at Grade 8 and search the effective way forwards to minimize the challenges. The mixed method research design was employed. The population of this study was the Grade 8 Science teachers in Bangladesh. A set of survey questionnaire and interview schedule each was used for data collection. Data collection tools were reviewed by science curriculum experts and pre-tested by Grade 8 science teachers. Descriptive statistics was used for survey data interpretation. To interpret the findings, both qualitative and quantitative data were triangulated. The challenges identified by the Grade 8 Science teachers were unfriendly textbook, inadequate physical and instructional facilities, lack of teachers' professional skills, irregular in-service trainings, inefficient instructional monitoring and mentoring system. The way forwards were introducing regular professional development initiatives, upgrading instructional facilities, improving the physical environment, updating Grade 8 Science textbook and establishing a continuous instructional monitoring and mentoring system.

Keywords: *curriculum, Grade 8, Science teachers, Bangladesh*

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Introduction

The curriculum implementation process involves helping the learner to acquire knowledge and experience. Mkpa (2007) describes the concept of curriculum implementation as the actual engagement of learners with planned learning opportunities. Therefore, putting the curriculum into operation requires an implementing agent and teacher is the agent in the curriculum implementation. In Labane's (2009) words, curriculum implementation is the task of translating the curriculum document into the actual teaching-learning process where the combined efforts of the students, teachers and others concerned is crucial. In fact, curriculum implementation requires a change in their beliefs, teaching approach and use of materials (Fullan, 2007). As such, there is a constant negation and renegotiation in the curriculum implementation process between the teachers and students (Ogar & Opoh, 2015). It also incorporates the use of physical facilities, instructional facilities and the adoption of appropriate pedagogical strategies and methods. Science laboratory is central to scientific instruction, and it forms an essential component of science education. It is where various kinds of practical work are carried out by students under the guidance of their teachers.

Successful implementation of the curriculum heavily depends on the readiness of teachers as well as schools (Remillard, 1999). Moreover, teachers are the key personnel in implementing the curriculum for larger student support (Lassa, 2007). Similarly, the role of instructional facilities is equally significant for an effective learning environment in schools (Ahmadi & Lukman, 2015). Therefore, teachers should be able to understand the changes in the curriculum as well as to adjust the teaching learning environment so as to fully implement the curriculum (Zanzali, 2003). However, teacher transformation, especially their readiness and preparedness for effective curriculum implementation in a changed context, is still a tough job in most of the developing countries (Dhakal, 2017). For successful achievement of academic performance in schools, there is a need to provide key physical infrastructure which includes: school library, classrooms and various types of solid waste disposal (Ahmadi & Lukman, 2015). Chaney and Lewis (2007) also observed that infrastructural facilities, scientific equipment and tools are essential for implementing the curriculum effectively. Moreover, socio-economic, political, cultural and technological background of a society also impacts the quality of curriculum implementation (Ogar & Opoh, 2015).

Therefore, the larger society will have a significant impact on the entire schooling process, including the curriculum implementation.

Significant advances have been achieved in recent years in the provision of secondary education in Bangladesh. The success rate of this education, especially in school enrolment, reduction of gender parity and in public examination, is very much remarkable. But the standard of science education in Bangladesh is not satisfactory (Hossain, 2015). The situation of science education in secondary schools in Bangladesh is a big concern to all, including the government and society at large. As such, eminent scientists and science educators are worried that science is losing its appeal in an alarming shift of choice. Among several factors contributing to the qualitative and quantitative decline in science education, weak curriculum and textbooks, feeble teaching and assessment methods, lack of adequately trained teachers and laboratory facilities, poor salaries of the teachers, and students' sliding interest are cited the main reasons (Hossain, 2000). As a consequence, as Chowdhury (2009) mentioned, the situation of science teaching in schools and colleges in Bangladesh is far from satisfactory.

An evaluation study of 1995 Science Curriculum revealed that the curriculum was not implemented as it was intended (National Curriculum and Textbook Board, 2010). This study revealed that teachers were not aware of the curriculum, and most of them did not use the curriculum in classroom practice. This study identified large class size, an excess class load of teachers, shortage of classrooms and laboratories, inadequate supply of teaching aids and science instruments, inappropriate classroom space and furniture, lack of teachers' professional skills as the major challenges for implementing science curriculum (NCTB 2010). Bangladesh revised its National Curriculum 1995 and introduced the National Curriculum 2012 in 2013. In this direction, the Ministry of Education in Bangladesh has also arranged two in-service trainings, namely Curriculum Dissemination Training (CDT) and Practical Science Teaching (PST) training, for enhancing teachers' competences. Secondary Education Sector Investment Program supplied scientific instruments to all secondary schools 9n Bangladesh (Ministry of Education, 2016). Against this background, this study attempt to document whether the limitations of instructional facilities and physical facilities mentioned above are still tenable in secondary schools in Bangladesh. The specific objectives of this study are a) to identify the challenges encountered by the Science teachers in implementing Science

Curriculum 2012 at Grade 8; and b) to search for effective ways to overcome the challenges. In the following section, I outline the theoretical framework of this study.

Theoretical Framework of the Study

This study was guided by TIMSS (Trends in International Mathematics and Science Study) framework for curriculum analysis which has been used internationally (Robitaille et al., 1993; Valverde, Bianchi, Wolfe, Schmidt, & Houang, 2002). The TIMSS framework is based on a model of curriculum that has three components: the intended curriculum, the implemented curriculum and the attained/achieved curriculum as in Figure 1 (Mullis & Martin, 2013).

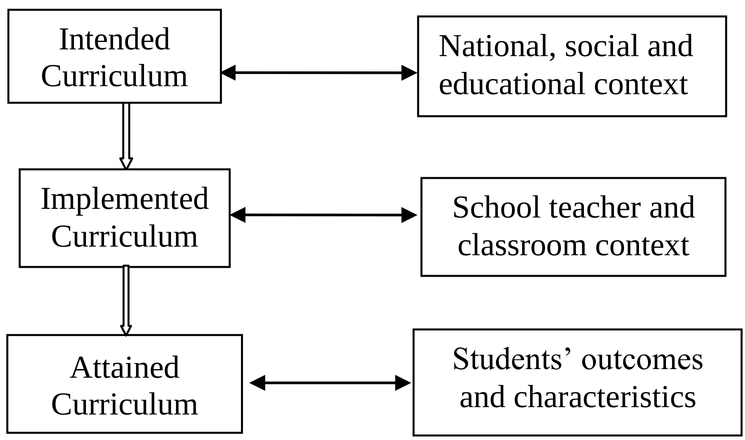

Figure 1. TIMSS framework of intended implemented and attained curriculum.

In this model (Figure 1), the intended curriculum is at the educational system level. The implemented curriculum is made up of what is actually taught in the classroom, who teaches the curriculum, and how it is taught. The attained curriculum is at the student level, and according to the TIMSS includes what students have learned, and their attitudes towards mathematics and science (Mullis & Martin, 2013). This study concentrated only on the second component. According to TIMSS framework, the teacher is the key agent of curriculum implementation, and these teachers need adequate instructional and physical support for proper implementation of the curriculum.

Methods

Considering the nature of the research problem, I have adopted a mixed-methods approach in this study. The reason for choosing a mix-methods approach is that it provides rich and comprehensive data because data from one source could enhance, elaborate or complement data from the other source (Biesta, 2012; Creswell, 2005).

Population and Unit of the Study

There are 20465 secondary schools in Bangladesh (Bangladesh Bureau of Educational Information and Statistics, 2018) and the population of this study included Grade 8 Science teachers. The study unit was the Grade 8 Science teachers under the selected schools. For this study, secondary schools were identified in terms of their locations (urban and rural) and financial types [Government (Govt.) schools, MPO schools (Government-aided) and Self-Financed (SF) schools].

Sampling Techniques and Sample Size

In Bangladesh, there are 64 districts under eight divisional administrative units. For the survey, 32 districts, 4 from each divisional unit, were selected by using simple random sampling techniques. 320 survey schools were selected by taking 10 schools from each of 32 districts by using stratified random sampling techniques. For the interview, eight districts and 24 interview schools were selected by taking three schools from each of eight districts under eight divisional units by using the purposive random sampling techniques. One Grade 8 science teacher was selected by Head teachers for survey and interview from each of the research schools. The total sample size of this study was 344 (survey 320 & Interview 24).

Data Collection Strategies

The key data collection tools in this study included survey questionnaire and interview schedule. Thus, I administered the survey questionnaire to collect quantitative data, whereas I employed interview technique to generate qualitative data. Along the following paragraphs, I have described the process of conducting the survey and the interview with my participants.

Survey. The questionnaire was used to collect survey data. Survey questionnaire constitutes an important and popular technique that is widely used to study the attitudes, opinions, perceptions and preferences in the field of educational research

(Dörnyei, 2007). Creswell (2009) described questionnaires as: "The questionnaire is an important instrument of research, a tool for data collection. It is considered a set of questions arranged in a certain order and constructed according to specially selected rules". Questionnaires may give three types of data about respondents, which are: 1. Factual 2. Behavioural and 3. Attitudinal (Creswell, 2009). The survey questionnaire included three sections. First sections included a checklist to collect teachers background information, the second section was a 5-point Likert scale to identify the challenges faced by Grade 8 Science teachers, and the third section was an open invitation for way forwards to overcome the challenges. The survey questionnaire was sent to the respective head teacher through government postal service along with the permission letter obtained from the Directorate of Secondary and Higher Education.

The return rate of the survey questionnaire was found satisfactory. A total of 302 out of 320 participants responded to the questionnaire, giving a return rate of 94.38%. Only 18 questionnaires were excluded, as they were not returned. The missing questionnaires (18) all belonged to rural teachers.

Interview. A semi-structured interview schedule was used in this study. Dörnyei (2007) and Talmy (2010) argue that interviews are one method most often used as a means of obtaining in-depth information about a participant's experiences, attitudes, perceptions, beliefs, thoughts, knowledge, and feelings of a problem being researched. Since the aim of this study is to identify the challenges and the way forwards to overcome the challenges, adopting the interview method as a means of data generation, as it allows to enter into the inner world of the teachers and to gain a better understanding of their perspectives (Johnson & Christensen, 2008). The interview schedule included three sections. Section one included teachers background information, section two identified the challenges encountered by Grade 8 Science teachers, and section 3 recommended the ways to meet the challenges. All the interviews started in local language Bangla. Common and familiar English words were used when teachers felt a need for clarification or elaboration or expression for making a clear understanding of the questions to teachers.

Piloting Study and Tool Validation

Piloting the instruments for data collection is of critical importance to ensure that the items are not ambiguous, confusing or poorly prepared (Wiersma & Jurs, 2009). A pilot study is conducted sometime prior to the main study to refine the techniques and tools a researcher plans to use (Ashley, 2012). In this study, the pilot study aimed at ensuring the comprehensibility of the tools so that teachers would have no difficulty understanding them. The study instruments were reviewed by three curriculum experts who were involved in developing the Grade 8 science curriculum. Then the instruments were pre-tested with five Grade 8 Science teachers (3 rural and 2 urban). The piloting of the questionnaires helped to remove the ambiguities in the questionnaire and also to identify omissions, redundancy and irrelevance of the items. The pilot study suggested that an average of 30 minutes would be required for the completion of the questionnaire and an average of 45 minutes would be required for completing the interview.

Data Analyses and Interpretation

In order to accommodate the large volume of data generated by the survey questionnaire, spreadsheets were developed using statistical package for social science (SPSS) version 21. The quantitative data were classified and tabulated according to the theme approach as drawn from the objectives of the study. The quantitative analysis focused on providing descriptive statistics and establishing statistically significant relationships between the variables. The t-test was used to compare the opinions of rural and urban teachers in order to determine the significant difference that existed between their mean scores. On the other hand, ANOVA was used to compare the opinion of the Govt., MPO and SF teachers to determine the significant difference that existed between their mean scores. These data were then converted to frequencies that were used to help to develop numeric data from the response of each category.

In the sections that follow, I have presented the findings in two braod themes: a) challenges; and b) way forward. Then, I have discussed the findings to derive significant knowledge for implementing the grade 8 science curriculum in the context of Bangladesh.

Challenges in Implementing Grade 8 Science Curriculum

Research respondents were requested to identify the challenges as they faced in implementing Grade 8 Science Curriculum. In survey, Five-point Likert Scale was used. The challenges were written in 'statement' form under four domains: Curriculum and textbook, Instructional facilities, and Teachers professional skills. Every statement was categorized into five possible responses as 'strongly agree (SA)', 'Agree (A)', 'No

Opinion (NO)', 'Disagree (D)', and 'Strongly disagree (SD)'. The scores for these five possible responses were 5 for SA, 4 for A, 3 for NO, 2 for D and 1 for SD.

Curriculum and Textbook

In table 1, survey teachers identify the challenges regarding curriculum and textbook. Respondent teachers identified textbook, absence of teacher's guide, and student dependency on the guide as challenges in implementing Grade 8 Science curriculum.

Table 1

Teachers' Opinions on Curriculum and Textbook

S.N.	Statement	School		Mean score	Std. D	Sig.	Remarks
1.	Grade 8 science curriculum is overloaded	Rural	198	2.71	1.345	.200	NS
		Urban	94	2.93	1.289		
		Govt.	32	2.91	1.329		
		MPO	235	2.77	1.324	.853	NS
		SF	25	2.76	1.422		
2.	Grade 8 Science textbook has insufficient exercises	Rural	196	3.46	1.242	.102	NS
		Urban	94	3.70	1.035		
		Govt.	32	3.59	1.214		
		MPO	234	3.53	1.180	.937	NS
		SF	24	3.58	1.213		
3.	Grade 8 Science textbook has insufficient instructions for conducting practical	Rural	199	3.15	1.246	.386	NS
		Urban	95	3.28	1.200		
		Govt.	32	3.19	1.091		
		MPO	236	3.21	1.260	.877	NS
		SF	26	3.08	1.164		
4.	There is no teacher's guide	Rural	195	3.23	1.296	.399	NS
		Urban	93	3.37	1.258		
		Govt.	30	3.40	1.354		
		MPO	233	3.27	1.259	.823	NS
		SF	25	3.20	1.258		
5.	Students' are dependent on guidebooks	Rural	199	3.61	1.246	.452	NS
		Urban	94	3.49	1.285		
		Govt.	31	3.81	1.223		
		MPO	236	4.14	0.967	.172	NS
		SF	26	4.16	0.898		

Table 1 shows that the mean score for item 1 is less than 3.0, and for the rest of the items, mean scores are greater than 3.0. This indicates that the current Grade 8 Science Curriculum is not overloaded. As the table shows, teachers identified textbook, absent of teachers' guide and students' dependency on guidebooks as challenges in implementing the Grade 8 Science Curriculum. All respondents irrespective of their locations and types opined almost the same. This table further reveals that the rural and urban research participants as well as the Govt. MPO and SF research participants did not differ significantly in all the items mentioned in the table in terms of their mean rating. All interviewed teachers recognized that Grade 8 science curriculum is not overloaded and this curriculum could be finished within the allocated period in an academic year. These findings are very similar to that of survey findings. Around two-thirds of the interview teachers (11 rural MPO, two urban govt. and four urban MPO) expressed their reservation on the quality of Grade 8 science textbook. In their opinion, Grade 8 science textbook was not students friendly. The textbook did not have enough exercises at the end of every chapter. Textbook incorporated practical, which needed more clear instructions. The textbook did not provide guidelines to develop 'low cost/no cost' teaching aids. Furthermore, these teachers thought that textbook was not a self-driven book and did not help students to develop a higher order of thinking ability. These teachers also expressed their concern-on students' dependency on the guide book. They remarked that a good textbook could help students to reduce guide book dependency.

Instructional Facilities

In table 2, survey teachers identify the challenges regarding instructional facilities. Instructional facilities include teachers' class load, scarcity of scientific aids & instruments, unsuitable classroom furniture and Classroom size, large class size and absence of regional resource center as issues in implementing Grade 8 Science curriculum. Respondent teachers identified all the issues as challenges except scarcity of scientific aids and instruments by urban teachers and government teachers.

Table 2

Teachers' Opinions on Instructional Facilities

S.N.	**Statement**	**School**	**Frequency**	**Mean**	**Std. D**	**Sig.**	**Remarks**
1.	Teachers are overburden by class load	Rural	196	3.58	1.261	.121	NS
		Urban	93	3.82	1.160		
		Govt.	32	3.84	1.167	.631	NS
		MPO	231	3.62	1.220		
		SF	26	3.69	1.436		
2.	Scarcity of scientific aids and instruments for practical teaching	Rural	199	3.46	1.290	.003	S
		Urban	95	3.38	1.280		
		Govt.	32	3.10	1.148	.001	S
		MPO	236	3.31	1.299		
		SF	26	4.00	1.200		
3.	Unsuitable classroom furniture and Classroom size	Rural	201	3.81	1.268	.000	S
		Urban	95	3.13	1.274		
		Govt.	32	3.00	1.270	.010	S
		MPO	238	3.62	1.293		
		SF	26	4.00	1.296		
4.	Large class size	Rural	200	3.62	1.235	.496	NS
		Urban	94	3.58	1.198		
		Govt.	32	3.59	1.241	.058	NS
		MPO	236	3.64	1.186		
		SF	26	3.04	1.428		
5.	There is no regional resource center	Rural	200	4.14	0.949	.414	NS
		Urban	92	4.03	1.084		
		Govt.	31	3.81	1.223	.231	NS
		MPO	236	4.14	0.967		
		SF	25	4.16	0.898		

As seen in Table 2, all teachers identified excessive-class load, unsuitable classroom furniture, and large class size as challenges in implementing Grade 8 Science Curriculum as the mean scores were greater than 3.0. Although rural teachers, urban teachers and SF teacher identified scarcity of scientific aids and instruments for practical teaching as a challenge (mean greater than 3.0) but MPO teachers and Govt. teachers did not (mean less than 3.0) identified Rural, MPO and SF schools suffered badly due to the scarcity of scientific aids and instruments. Rural teachers, urban teachers, MPO teachers and SF teachers identified the absence of a regional resource center as a challenge as their mean scores are greater than 4.0. This table further reveals that the rural and urban research participants as well as the Govt. MPO and SF research participants did not differ significantly in items (1, 4 & 5) mentioned in the table in terms of their mean rating. But they differ significantly in items (2 & 3) mentioned in the table in terms of their mean score.

Very similar to survey findings, most of the interview respondents (91.66%) identified overcrowded classrooms, inappropriate classroom size and space, classroom environment and scarcity of scientific instruments as limitations of school facilities and challenges which hindered the implementation of the curriculum. In numerical terms, 22 of the interviewed teachers out of 24 (13 rural MPO, 1 rural SF, 2 urban govt. and 5urban MPO) reported that numbers of students in their classrooms were too big for the limited available capacity of classrooms size and furniture. These teachers noted that the number of enrolling students were almost double the capacity of the classroom and furniture. One rural MPO teacher mentioned that although the number of students was 83 and but the capacity of the class was for only 45. Teachers indicated that, in such situations, it was difficult for them to apply student-centred teaching-learning techniques, practical science teaching techniques and conduct the continuous assessment. These teachers further mentioned that schools were facing a severe shortage of scientific instruments. Classroom furniture was not appropriate for conducting practical science teaching. They told that they had nothing to do but using the lecture method.

Teachers' Professional Skills

In table 3, survey teachers identify the challenges regarding teachers' professional skills. Teachers' professional skills include the ability to use student-centred teaching approaches, the ability to develop creative questions, the ability to use practical science teaching. Respondent teachers expressed mix opinions.

Table 3

Teachers' Opinions on Teachers' Professional Skills

S.N.	Statement	Schools		Mean	Std. D	Sig.	Remarks
1.	Lack of skills for using students-centered teaching approach	Rural	199	3.12	1.360	.032	S
		Urban	92	3.06	1.180		
		Govt.	30	3.10	1.167	.016	S
		MPO	235	3.02	1.319		
		SF	26	3.46	1.272		
2.	Limitations in developing of creative question	Rural	194	3.23	1.327	.114	NS
		Urban	91	3.06	1.382		
		Govt.	30	2.77	1.305	.261	NS
		MPO	229	3.17	1.336		
		SF	26	3.27	1.485		
3.	Limitations in applying practical science teaching	Rural	199	3.86	1.291	.018	S
		Urban	93	3.48	1.167		
		Govt.	32	3.31	0.998	.039	S
		MPO	235	3.75	1.264		
		SF	25	3.16	1.434		

Table 3 shows a mix response. The mean scores of the items 1 and 2 were greater than 3.0 for rural teachers. On the other hand, urban teachers and Govt. teachers mean score for all the items are less than 3.0. These findings indicate that urban teachers did not agree with the statements mentioned in the table as challenges. On the other hand, rural teachers agreed with the statements 1 and 2 as challenges but did not agree with statement 3 as a challenge. SF teachers admitted of having limitations in professional skills mentioned in Table 3. MPO teachers admitted items 1 and 2 as challenges. This table further reveals that the rural and urban research participants as well as the Govt. MPO and SF research participants did not differ significantly in items (1& 3) mentioned in the table in terms of their mean rating. But they differ significantly in items 2 mentioned in the table in terms of their mean scores. Interview teachers identified professional limitations as a challenge in curriculum implementation. They acknowledged that they were facing problems in using student-centred teaching techniques, in developing creative questions, and practical science teaching. As they said, science curriculum incorporated some new changes, especially in pedagogy and student's assessment. The curriculum introduced practical science teaching in the teaching-learning process. The curriculum emphasized using student-centred teaching approach in classroom teaching and introduced continuous assessment. All research respondents opined that the in-service trainings provided by the MoE were insufficient and they raised questions regarding the quality of the training.

Way Forward to Overcome the Challenges

Survey and interview teachers were requested to provide way forwards to overcome the challenges they were facing for implementing Grade 8 science curriculum. In the survey, it was an open-ended question. Teachers' recommendations were categorized into five sub-domains in the context of curriculum implementation. Sub-domains were: 1) Curriculum and textbook; 2) In-service training; 3) Instructional supports; and 4.) Physical facilities. Recommendations are expressed in terms of frequency distribution and percentage in tables (4-7)

Way Forward I: Curriculum and Textbook

Table 4 shows the way forwards I related to curriculum and textbook. Survey teachers recommended to revisit Grade 8 Science textbook, include practical in junior certificate examination(JSC) and introduction of teachers-students' friendly continuous assessment (CA).

Table 4

Teachers' Recommendations on Curriculum and Textbook

S.N.	Recommendations	Teachers		Frequency	Percentage
1.	Include detail instructions for practical in Grade 8 Science textbook	Rural	206	165	80.09
		Urban	96	77	80.20
		Govt.	32	22	68.75
		MPO	246	207	84.14
		SF	26	13	50.00
2.	Include more exercises at the end of every chapter of Grade 8 Science textbook	Rural	206	159	77.18
		Urban	96	74	77.08
		Govt.	32	21	65.62
		MPO	246	193	78.45
		SF	26	13	50.00

		Rural	206	127	62.87
		Urban	96	57	59.37
3.	Include practical in JSC examination	Govt.	32	13	50.00
		MPO	246	167	67.88
		SF	26	7	26.92
		Rural	206	98	47.57
		Urban	96	37	38.54
4.	Introduce teacher-student friendly CA	Govt.	32	13	40.62
		MPO	246	106	43.08
		SF	26	11	42.30
		Rural	206	37	17.96
		Urban	96	48	50.00
5.	Increase duration for practical teaching	Govt.	32	11	34.37
		MPO	246	82	33.33
		SF	26	9	34.61

As seen in Table 4, more than three-fourths of rural and urban teachers recommend for revisiting the Grade 8 Science textbook. MPO teachers' recommendation is very close to rural and urban teachers in this regards. Around two-fourths of Govt. teachers and only one-half of SF teachers recommended for revising Grade 8 Science textbook. Around three-fifths of rural and urban teachers recommended for the inclusion practical marks in JSC examination. MPO teachers' opinion in this regards are very close to rural and urban teachers. Only fifty perent Govt. teachers and one fourth SF teachers recommended for the inclusion of practical marks in JSC examination. Around one half rural teachers and one-third urban teachers recommended for making CA teacher-student friendly. Around two-fifths of Govt., MPO and SF teachers recommended for making CA teacher-student friendly.one-sixth rural teachers and one-half of urban teachers recommended for increasing class duration for conducting the practical class. On the other hands, around one-third of Govt., MPO and SF teachers opined for increasing class duration for conducting the practical class. Survey findings closely match with the interview findings. Most of the interviewed teachers (91.66%, 14 rural MPO, 2 urban Govt., 7 urban MPO) suggested for the inclusion of detail instructions for practical science teaching and more exercises at the end of every chapter in science textbook of Grade 8. As they reported, current science textbook consists only a sample of creative questions at the end of every chapter. Interviewed teachers (70.83%, 10 rural MPO, 1 rural SF, 1urban Govt., 5 urban MPO) also demanded to incorporate practical in JSC examination and to introduce teacher-student friendly continuous assessment system. They opined that if practical is included in the public examination, school authority will take initiatives to conduct practical.

Way Forward II: Teachers' Professional Development

Table 5 shows the way forward II related to teachers' professional development. Survey teachers recommended for professional development training on practical science teaching, CA, creative questions, subject content and digital content development.

Table 5

Teachers' Recommendations for Teachers' Professional Development

S.N.	Recommendations	School		Frequency	Percentage
1.	Arrange training on practical science teaching	Rural	206	198	96.11
		Urban	96	94	97.91
		Govt.	32	30	93.75
		MPO	246	236	95.93
		SF	26	26	100.00
2.	Organize training on CA	Rural	206	192	93.20
		Urban	96	90	93.75
		Govt.	32	25	78.12
		MPO	246	234	95.12
		SF	26	23	88.46
3.	Arrange training on creative question development	Rural	206	175	84.95
		Urban	96	90	93.75
		Govt.	32	27	84.37
		MPO	246	212	86.17
		SF	26	26	100.00
4.	Arrange training on subject content	Rural	206	128	62.13
		Urban	96	49	51.04
		Govt.	32	5	15.62
		MPO	246	150	60.97
		SF	26	22	84.61

5.	Arrange training on digital content development	Rural	206	68	33.01
		Urban	96	53	55.20
		Govt.	32	22	68.75
		MPO	246	78	31.70
		SF	26	21	80.76

Frequency distribution of teachers recommended for in-service trainings shows in table 5. SF teachers' demands were very much higher than the others. All teachers strongly recommended for training on practical science teaching, CA and creative question. More than half of rural and urban respondents opined for training on subject content. Around three-fifths of the MPO teachers and four-fifths of the SF teachers demanded subject content training. Around one-sixth of the Govt. teachers also demanded subject content training. More than two-thirds of Govt. and Sf teachers recommended for digital content trainings. A good number of teachers (33.01% of the rural and 55.2% of the urban, 31.7% of the MPO) recommended for training on digital content development. Interview findings reflected survey findings. All interviewed teachers, irrespective of their location and types, proposed for regular in-service trainings. They demanded a regular professional development training program, and it should be organized frequently every year to familiarize the newcomers or to refresh the old ones. Professional development training should be organized in different divisions with quality trainers. All teachers recommended for Pedagogical Content Knowledge (PCK) training on science content and practical science teaching. They reported that practical science teaching needed in-depth skill in handling scientific instruments as well as science content knowledge. So training by including both content and pedagogy will give them more benefit. Most of the teachers (75.0%, 11 rural MPO, 1 urban Govt., 1 urban SF, 5 urban MPO)) mentioned that textbook incorporated new content and they did not have expected level of knowledge in those new areas. Teachers further mentioned that science is a multidisciplinary subject, and they did not have sufficient expertise in all areas incorporated in the textbook.

Way Forwards III: Instructional Supports

Table 6 shows the frequency distribution of way forward III related to instructional support to schools. Survey teachers recommended for adequate supply for scientific instruments and teaching aids, Reducing Grade 8 Science teachers' class load, Reducing

Grade 8 Science class size, provide a quality guide for teachers and establish a continuous monitoring and mentoring system.

Table 6

Teachers' Recommendations for Instructional Supports

S.N.	Recommendations	School		Frequency	Percentage
1.	Ensure adequate supply of instruments for science practical and teaching aids	Rural	206	193	93.68
		Urban	96	96	100.0
		Govt.	32	32	100.00
		MPO	246	231	93.90
		SF	26	26	100.00
2.	Reducing Grade 8 Science teachers' class load	Rural	206	191	92.71
		Urban	96	90	93.75
		Govt.	32	30	93.75
		MPO	246	240	97.56
		SF	26	11	42.30
3.	Reducing Grade 8 Science class size	Rural	206	171	83.01
		Urban	96	81	84.37
		Govt.	32	32	100.00
		MPO	246	205	83.33
		SF	26	15	57.69
4.	Provide quality guide for teachers	Rural	206	141	68.44
		Urban	96	56	58.33
		Govt.	32	19	59.37
		MPO	246	156	63.41
		SF	26	22	84.61
5.	Establish a continuous monitoring and mentoring system	Rural	206	167	81.06
		Urban	96	49	51.04
		Govt.	32	13	40.62
		MPO	246	186	75.60
		SF	26	17	65.38

All research respondents strongly demanded quality instructional supports. As Table 6 describes, more the ninety per cent of the research participants requested for supplying adequate practical instruments and teaching aids. More than ninety per cent teachers, except SF (only around two fifths) teachers, recommended for reducing class load. More than four-fifth of rural and urban teachers recommended for reducing the Grade 8 class size. All Govt. teachers recommended this. MPO teacher's recommendation was very close to rural and urban teachers in this regards. Only around SF teachers were recommended for reducing the class size. Significant number of teachers (more than sixty per cent) teachers recommended for quality teacher's guide and for establishing a sustainable monitoring and mentoring system. All interviewed respondents suggested for adequate instructional support to schools. These findings were much close to the survey findings. All interviewed teachers proposed for the supply of adequate practical instruments and teaching aids in the appropriate time. Most of the teachers (87.5%, 13 rural MPO, 1rural SF, 2 urban Govt., 1urban SF, 4 urban MPO) demanded reducing class size and class load. Around four fifths of the teachers (14 rural MPO, 2 urban Govt., 4 urban MPO) proposed for teacher's guide and three fourth of the respondents (12 rural MPO, 2urban Govt., 4urban MPO) recommended for CA guide and CA record-keeping tools. Three-fourths of the respondents (11 rural MPO, 3urban Govt., 4 urban MPO) demanded ICT related instruments and reference science textbook.

Way Forward IV: Improving Physical Facilities in Schools

Table 7 shows the frequency distribution of the way forward for improving physical facilities in schools. Survey teachers recommended for science laboratory, multimedia classroom, enlarged classroom size, increasing the number of classrooms, supplying student-centered classroom furniture, supplying appropriate size of writing boards and uninterrupted power supply.

Table 7

Teachers' Recommendations for Improving Physical Facilities in Schools

S.N.	Recommendations	Teachers		Frequency	Percentage
1.	Establish a science laboratory for Grade 8	Rural	206	186	90.26
		Urban	96	83	86.45
		Govt.	32	32	100.00
		MPO	246	212	86.17
		SF	26	25	96.15
2.	Create multimedia classroom for Grade 8	Rural	206	141	68.44
		Urban	96	71	73.95
		Govt.	32	31	96.87
		MPO	246	155	63.01
		SF	26	26	100.00

3.	Enlarge classroom size	Rural	206	176	85.43
		Urban	96	79	82.29
		Govt.	32	24	75.00
		MPO	246	209	84.95
		SF	26	22	61.11
4.	Increase number of classrooms	Rural	206	191	92.71
		Urban	96	57	59.37
		Govt.	32	9	28.12
		MPO	246	214	86.99
		SF	26	26	100.00
5.	Provide student-centered classroom furniture	Rural	206	180	87.37
		Urban	96	58	60.41
		Govt.	32	24	75.00
		MPO	246	195	79.26
		SF	26	19	73.07
6.	Supply appropriate size of writing board	Rural	206	176	85.43
		Urban	96	48	50.00
		Govt.	32	11	34.37
		MPO	246	188	74.42
		SF	26	25	96.15
7.	Ensure uninterrupted power supply	Rural	206	171	83.01
		Urban	96	58	60.40
		Govt.	32	6	18.75
		MPO	246	197	80.08
		SF	26	26	100.00

As table 7 shows, more than four-fifth of the respondents proposed to establish a separate science laboratory for Grade 8. More than four-fifth of rural and urban teachers requested for enlarging classroom size. More than two-third respondents demanded multimedia classroom for Grade 8 science. More than eighty per cent rural respondents suggested for more classrooms, student-centred classroom furniture, appropriate board size and uninterrupted power supply. On the other hand, more than three-fifth of the urban teachers also proposed for more classroom, student-centred classroom furniture and uninterrupted power supply. One-half of the urban teachers recommended for the appropriate size of the writing board.

On the other hand, all of SF teachers, 96.87% of the Govt. teachers and 63.01% of the MPO teachers demanded separate multimedia classroom for Grade 8. Around three-fourth of the Govt. and MPO teachers demanded large classroom size and more than three-fifth of the SF teachers also demanded the same. Around three-fourth of the research participants proposed for the student-centered classroom furniture. Majority of the MPO teachers (74.42%) and SF teachers (96.15%) appealed for the appropriate size of writing board and around one-third of the Govt. teachers also claimed the same. All of the SF teachers and more than four-fifth of the MPO teachers proposed for increasing number of classrooms and continuous power supply. A significant number of Govt. teachers also recommended for increasing the number of classrooms (28.12%), appropriate size of writing board (34.37%) and uninterrupted power supply (18.75%). Both survey and interview participants, irrespective of their locations and types of schools, gave almost the same way forwards for effective implementation of the Grade 8 Science Curriculum. The major recommendations were reviewing Grade 8 science textbook for making it teacher-student friendly, the inclusion of practical in public examination, continuous in-service trainings on practical science teaching, creative questions, continuous assessment, adequate supply of scientific instruments and teaching aids, reducing class load and class size, quality teacher's guide, separate science laboratory and multimedia classroom for Grade 8, large and more classroom, continuous power supply and continuous instructional monitoring and mentoring.

Discussion

Findings show that the Grade 8 Science teachers used in this study agreed with all the challenges mentioned in the questionnaire affecting the implementation of Grade 8 science curriculum except the statement 'Grade 8 science curriculum is overloaded'. The findings reveal that unfriendly Grade 8 science textbook, absence of teachers' guide and students' dependency on guidebooks were identified as challenges under curriculum and textbook domain. Teachers agreed that the Grade 8 science curriculum was not overloaded, but the Grade 8 Science textbook was not student-friendly. The textbook did not have enough exercises at the end of every chapter. Textbook incorporated practical, which needs more explicit instructions. The textbook did not provide guidelines to develop low cost or no cost teaching aids. Furthermore, the textbook was not a self-driven and did not help students to develop higher-order thinking ability. These teachers also expressed their concerned-on Students' dependency on guide book was identified as a challenge. A good textbook can help students to reduce guide book dependency.

Teachers’ excess class load, scarcity of scientific instruments, unsuitable classroom furniture and classroom size, large class size and absence of regional resource center were also identified as challenges under instructional facilities domain. This study found that there was a serious lack of instructional facilities and resources almost in every school in Bangladesh, which is very similar to Ayodele (2009) findings. He found that lack of well-equipped laboratory, lack of qualified teachers, inadequate science teachers, poor utilization of available science teaching materials and large class size. Likewise, Adeogun (2006) discovered a very strong positive significant relationship between instructional resources and academic performance. He showed that students' academic performances increased significantly if teachers guide students with sufficient instructional facilities. The work also aligned with Ekpo (2006) who argued that students are compelled to memorise due to the absence of necessary equipment for experimentation. Moreover, this current study indicated that classroom organization should support teachers' activities. A well-organized classroom help teacher to execute curriculum plan. According to Ehiametalor (2011), facilities are those factors which enable production workers to achieve the goals of an organization. Similarly, Olokor (2006) observed that the use of instructional facilities enhances learning experiences and leads to interaction within the learning environment.

Teachers further identified that lack of skills for using student-centered teaching approach, limitations in writing creative questions and limitations in applying practical science teaching approach as challenges under teachers' professional skills domain which were similar to the findings of Rahman and Begum (2012). They showed that, in Bangladesh, teachers are facing problems in explaining the science content, in providing real-life examples in linking the principles of science with real-life examples and, in providing current ideas regarding science content. This study finding also agreed with some earlier studies (e.g. Mupa & Chinooneka, 2015; Zwane & Malale, 2018) which pointed out that lack of professional skills among teachers lead to inappropriate teaching methods which affects effective learning. Adams and Onyene (2011) expressed the qualification and experience of the teacher as a pre-requisite to the effective implementation of the curriculum.

This study explored that the existing facilities in secondary schools in Bangladesh did not support curriculum implementation requirements. In this regards, rural schools are suffering more than urban schools. Government schools are found in better condition than MPO schools. SF schools are suffering the worst. This study explored the way forwards to overcome the identified challenges. These are the introduction of good textbook and teachers guide, reduce teachers' class load, adequate supply of scientific aids and instruments, suitable classroom furniture and classroom size, small class size, establish regional resource centers and continuous professional development initiatives for teachers which will enable teachers to deliver effective teaching thereby leading to the attainment of behavioral objectives.

The achievement of objectives of any level of education depends largely on the effective implementation of its planned programme (Ahmadi & Lukman, 2015). Onyeachu (2008) observed that no matter how well a curriculum of any subject is planned, designed and documented, implementation is important. This is because the problem of most programmes arises at the implementation stage. Without taking appropriate prior preparation, MoE in Bangladesh introduced science curriculum 2012 at Grade 8 in secondary schools. The challenges identified by the Science teachers remained the same as they faced while implementing science curriculum 1995. The MoE needs to look at curriculum implementation as a change process and develop the system to manage the change effectively.

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