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Editorial

The National Academy for Primary Education (NAPE) is going to publish the twelfth issue of the "Primary Educational Journal," which is a yearly publication. This journal opens a professional scope for educational researchers to share their study findings on different primary sector issues. As an apex training and research institute in primary education, NAPE wants to disseminate innovative thoughts and ideas to support quality primary education.

This issue includes six research-based articles that cover different essential topics and the problems of primary education. The first article is about Setting Reading Fluency Benchmark in Bangla. There was no benchmark in Bangla reading fluency at the primary level, which is necessary to check students' reading performances regarding the targeted level. This study sets a reading fluency benchmark for grade III and grade V in Bangla. The second article is on the Impact of Instructional Games on Students' Learning Achievement in Mathematics at Primary Level in Bangladesh. The study investigates the impact of instructional games on students' learning achievement in mathematics at the primary level in Bangladesh. The study's findings indicate that the instructional game's method is more effective than the conventional lecture-based method in achieving learning outcomes in mathematics at grade I. The third article focuses on A Snapshot of 50 Years Progress and Problems of Primary Education in Bangladesh. The main objective of this paper is to explore the progress and constraints of primary education in Bangladesh for the period of 1971 to 2020. It is found that the number of schools, students, and teachers has expressively increased in the last 50 years in Bangladesh. The education policies had some excellent suggestions for ensuring the progress of primary education. However, some of the recommendations have not been implemented yet.

The fourth article tries to explore the Pre-primary teachers' perceptions and beliefs about play-based pedagogy. The research investigates the pre-primary teachers' perceptions and beliefs about play-based pedagogy in Bangladesh. The fifth article is on Play-Based Approach for Developing Number Concepts at Pre-Primary Level in Bangladesh: Practices, Challenges, and Ways to Overcome. The study explores the practices for number concepts development in the pre-primary level education of Bangladesh and the teachers'

challenges during the play-based approach. The results show that teachers mainly used a traditional direct instruction rather than a play-based approach during pre-primary mathematics teaching. Inadequate budget for buying play materials, workload, large class size, and managing special needs students have been identified as the challenges of implementing a play-based approach. The final article aims to analysis the Weakness in Four Mathematical Operations of Grade Three Students: Causes & Remedies. The study findings indicate that student's performance is not satisfactory. The maximum numbers of teachers face problems in teaching grade 3 mathematics. The researchers outlined that In mathematics lessons, teachers have to follow a student-centered approach; using teaching aids, collaboration in solving problems, discussion, and feedback.

I think all of these papers will contribute to ensure quality primary education in Bangladesh. I believe that we have to make an evidence-based solution process to take new interventions in the primary sector, which will help the policy makers formulate and implement policy effectively.

I would like to give my heartful thanks to the editorial board members for providing their expertise and doing the hard work needed for making the journal an international standard. I would also like to thank the panel of experts for their intellectual support and thoughts to ensure the papers' standard.

Finally, I would significantly appreciate readers' opinions and comments on the present issue that encourage us to enrich and improve future publications.

Md. Shah Alam (Additional Secretary)
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Setting Reading Fluency Benchmark in Bangla for the Students of Grade III and Grade V

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Abstract

Reading is one of the most significant media of learning. Reading with comprehension mostly depends on reading fluency. It is necessary to measure students' fluency through the reading rate of words per minute to know the level of comprehension. There was no benchmark in Bangla reading fluency at the primary level, which is necessary to check students' reading performances regarding the targeted level. This study aims to set a reading fluency benchmark for grade III and grade V in Bangla. This study followed quantitative approaches with a cross-sectional survey design. A total of 1536 students from both grades were selected through a multistage cluster sampling procedure. Two types of texts for each grade were developed and finalized after piloting to administer. The median method was used for setting the fluency benchmark as many countries already had used it for the same purpose. This study recommended setting the reading fluency benchmark for grade III in Bangla at 46 CWPM and 54 CWPM for grade V. It also recommended that policymakers need to take the necessary teaching-learning interventions to achieve this benchmark.

Keywords: Reading Fluency, Benchmark, CWPM, Language, Primary Education, Bangladesh

Introduction

Reading acts as an essential gateway to personal and social development, and it also contributes to a great extent to economic growth (Holden, 2004). At an early stage, reading starts with decoding written symbols or letters to understand the meaning or get information. After achieving the foundation of reading, our reading depends on the sense of reasoning and pleasure, which enable us to interpret and comprehend what we have read.

Developing reading skills requires a great extent of practice reading materials, taking notes of spelling of the new words and their pronunciation and uses, and the punctuation marks that lead the reading for meaningful purposes with comprehension(Strauss, 2015). Reading skills include fluency, decoding, and vocabulary development because these are crucial to comprehending any written materials. These reading skills help readers become lifelong readers who think critically and understand the message of written texts. When an individual struggles to read, s/he cannot achieve expected competencies in his/her academic life, which also impacts their social and economic development.

In some cases, fluency becomes synonymous with just speed. Though generally reading fluency refers to the ability to read accurately at a reasonable rate and prosody. Still, comprehensively, it can be defined as *"reading fluency is the ability to accurately read at an appropriate rate while demonstrating prosody and comprehension of the text"* (Melissa, 2020). According to International Literacy Association (2018), reading fluency is the combination ofrationally accurate reading, at a reasonable rate, with appropriate expression and perfect comprehension to read a text. It is well established by several research studies that there is a strong correlation between fluency and comprehension

In the National Curriculum-2012 document, it is clearly stated that students will read fluently with correct and standard pronunciation. From class 1 to 5, reading has been emphasized in Bangla language curricula, and it is expected that at the end of class 5, students will be able to read graded written materials fluently with correct and standard pronunciation(National Curriculum and Textbook Board (NCTB), 2012). Besides, in the Sustainable Development Goals (SDG) document, target 4.1.1 stated

> *'Proportion of children and young people (a) in Grade 2 or 3; (b) at the end of primary education; and (c) at the end of lower secondary education achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex.* (United Nations, 2020).'

They also suggested setting a benchmark considering the minimum proficiency level in a domain (mathematics, reading, etc.), which should be evidence-based and measured through learning assessments.

After revising the curriculum for the primary level in 2012, the government has taken different initiatives, including reading materials development, subject-based training and teacher training to develop students' reading competencies. Various programmes were also taken to develop the students' learning competencies, especially in the Bangla language. Last year, the government started the 'One day, One Word' programme to develop students' vocabulary and reading skills. Besides, the National Students' Assessment (NSA) has been conducted across the country to get the overall idea about students' performances in Bangla in grade III and grade V. The NSA deals with assessing Bangla reading competencies with comprehensions only, not including reading fluency. There are several studies conducted by different organizations to find out the fluency rate of the students. There is no study for grade III and V students to discover to what extent the students can read fluently. Now, the MoPME is concerned about how well students can read fluently with comprehension. It takes initiatives to set a reading benchmark to justify students' performance in terms of oral reading fluency in grade III and grade V. According to King & DeStefano (2015),"*A benchmark is a standard or point of reference against which things may be compared or assessed*".

The rationale of the study

Reading is the most effective medium of learning and reading itself is an excellent concern for learning. To get the pleasure of reading, a person has to be a fluent reader with understanding. At the early level of learning, students learn to read, and after achieving a basic foundation of reading, the learners learn something by reading. Through reading, students can have the letter knowledge, decoding, build a vocabulary of various subjects, and later become capable of evaluating and critically thinking. When students can achieve these reading sub-skills, they can recognize the sounds of the letters and words correctly. Moreover, they can read any written materials with proper speed, accuracy, and prosody.

Fluency is essential for bridging between word recognition and comprehension. A fluent reader can focus on the meaning of a passage rather than struggle with pronouncing words and considering accuracy, decoding or rate. Fluent readers can understand the inner meaning, in line and between line meanings of the text. By this comprehension, students can relate their experience with the text's meaning. If reading fluency is poor, they sometimes face obstacles to understanding and making proper meaning, and a slow reader also suffers from fatigue(Balsiger, 2020). Non-fluent readers mostly struggle with decoding to not concentrate on the meaning or understand what the text means. Moreover, reading fluency is also important to link between early and later reading phases(International Literacy Association, 2018).

So, it is necessary to measure and compare students' fluency through the reading rate of words per minute and the level of comprehension. At present, there is no benchmark in Bangla reading fluency at the primary level. So, the government and non-government schools and other educational institutions in Bangladesh cannot measure effective reading fluency. Setting a fluency benchmark allows the concerned authority to check their students' reading performances with the targeted level. After setting the Bangla language reading fluency benchmark, the policymakers of primary education can compare students' present fluency level with the set benchmark. After comparison, it may be possible to know what portion of our students are fluent readers and need additional support for developing fluency.

Objectives of the study

The main objectives of this study were to set a national benchmark for Bangla reading fluency at the primary level in Bangladesh. The specific objectives were:

1. to set a reading fluency benchmark for the students of grade III in Bangla;
2. to set a reading fluency benchmark for the students of grade V in Bangla.

Methodology

This study followed a quantitative approach using a cross-sectional survey design to conduct the national assessment to measure oral reading fluency at the government primary schools in Bangladesh. This study was conducted only at the Government Primary Schools (GPS) in Bangladesh.A total number of 2,924,975 and 2,096,384 students of grade III and grade V, respectively(BANBEIS, 2019) were the population of the study. A multistage cluster sampling strategy was used to select the sampled students from GPSs considering divisional, geographical, types of area (urban & rural) and gender issues (Fig. 2). As the population size is large enough (greater than 20,000),the sample was determined 1536 by

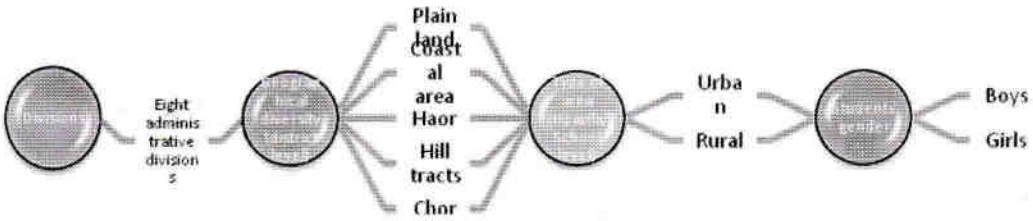

Figure 1: Sample selection at a glance

following statistical formula(*Sample size*= $\frac{Z^2 \times P(1-P)}{e^2}$) considering the design effect of 4.

Table 2 shows the sampling procedure at a glance.

Table 1: Sample procedure at a glance

Division	District	Upazila	School	Students (Grade III)		Total Students	Students (Grade V)		Total Students
				Girls	Boys		Girls	Boys	
8	16	32	128	768	768	1536	768	768	1536
Purposive Sampling		Simple Random Sampling		Systematic Random Sampling					

The research team arranged a workshop at NAPE to develop different types of texts for this study. After having the raw texts of each grade, the research team sent those texts to literature and linguistic experts of IER, DU, Jahangir Nagar University, RtR experts, and NAPE research experts for scrutinizing.The texts were then piloted and finalized.

The collected data were analyzed by applying quantitative data analysis procedures. According to Jukes et al. (2018), four different statistical methods were used to assess the reading fluency benchmark: mean, median, linear regression, and logistic regression.In this study, the median method was used as data supports the method.

Data Analysis and Interpretations

The analyzed data were presented here based on study objectives:

Findings for grade III students in Bangla reading fluency

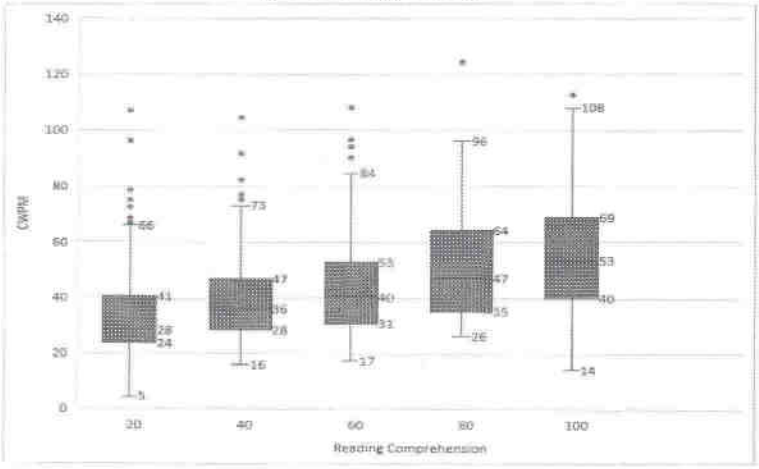

Figure 2: Box plot for descriptive text

This figure shows the scenario of reading comprehension vs pronunciation of correct words per minute (CWPM) for the *descriptive text* of grade III. It is found that students who read the text with 80% comprehension had a median of 47 CWPM whereas lower 25% students read 35 CWPM or less and upper 25% students read 64 CWPM or higher.

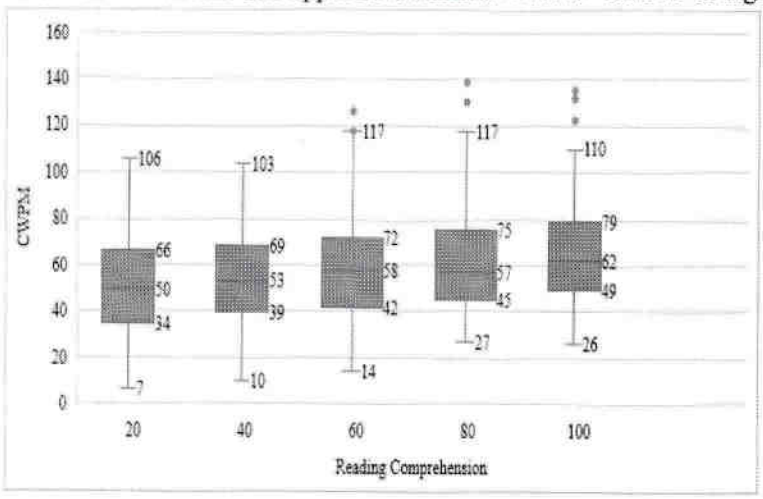

Figure 3: Box plot for imaginative text

This figure shows the scenario of reading comprehension vs correct word per minute (CWPM) for the *imaginative text* of grade III. It is found that students who read the text with 80% comprehension had a median of 57 CWPM whereas lower 25% students read 45 CWPM or less and upper 25% students read 75 CWPM or higher.

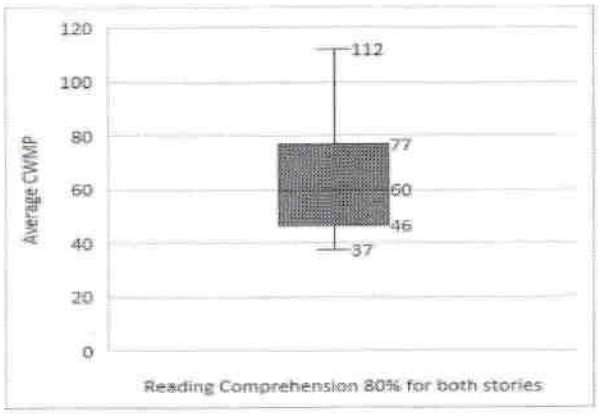

Figure 4: Box plot for both texts

This figure shows the scenario of reading comprehension vs correct word per minute (CWPM) for both descriptive and imaginative texts of grade III. Students who read both texts with 80% comprehension are plotted here. The mean of CWPM of two texts is calculated and shown on the 'Y' axis.

It is found that students who read the text with 80% comprehension had a median of 60 CWPM whereas lower 25% students read 46 CWPM or less and upper 25% students read 77 CWPM or higher. It is seen from the figure that the minimum CWPM with 80% comprehension was 37 from which it can be inferred that the minimum level of oral reading fluency is 37 CWPM with 80% comprehension for grade III.

Findings for grade V students in Bangla reading fluency

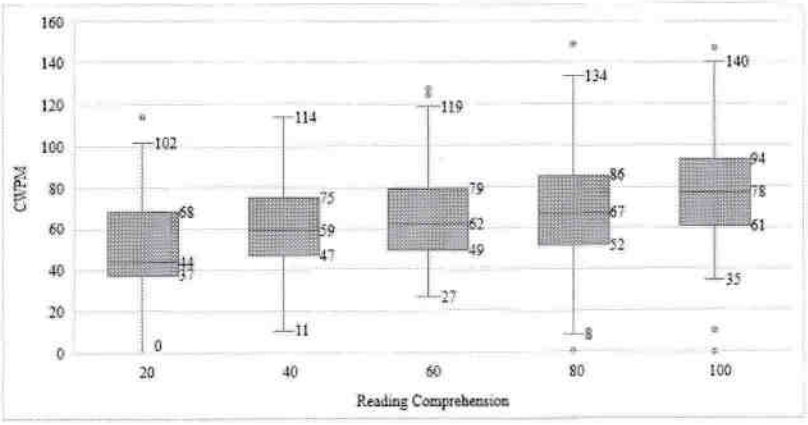

Figure 5: Box plot for descriptive text

This figure shows the scenario of reading comprehension vs correct word per minute (CWPM) for the *descriptive text* of grade V. It is found that students who read the text with 80% comprehension had a median of 67 CWPM whereas lower 25% of students read 52 CWPM or less and upper 25% students read 86 CWPM or higher.

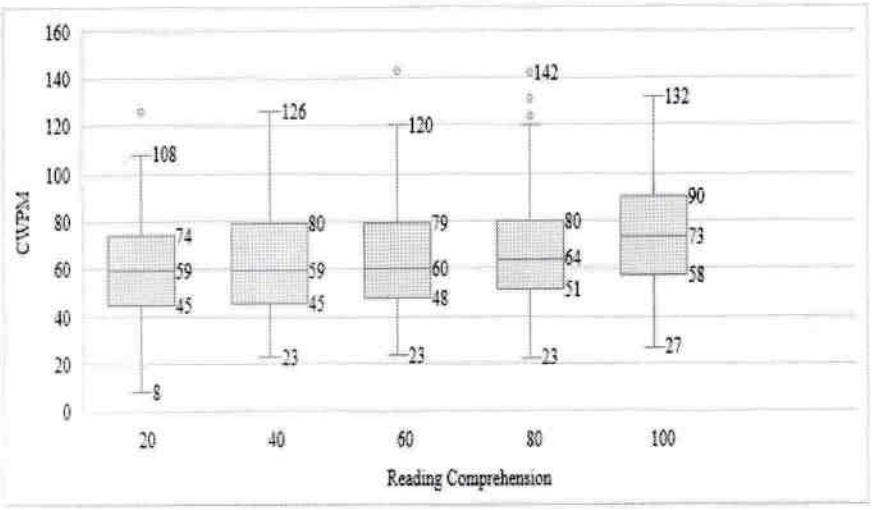

Figure 6:Boxplot for imaginative text

This figure displays the scenario of reading comprehension vs correct word per minute (CWPM) for the *imaginative text* of grade V. It is found that students who read the text with 80% comprehension had a median of 64 CWPM. In contrast, lower 25% of students read 51 CWPM or less, and the upper 25% read 80 CWPM or higher.

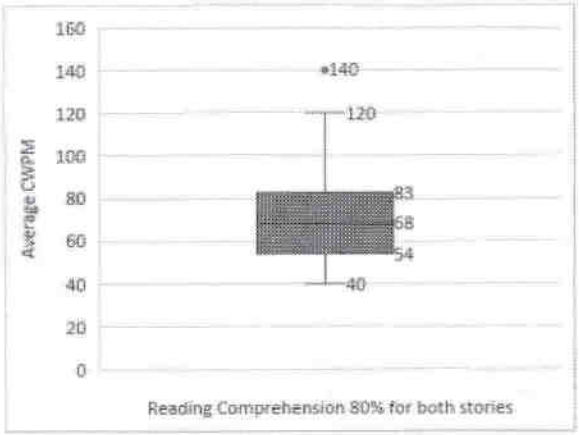

Figure 7: Box plot for both texts

This figure presents the scenario of reading comprehension vs correct word per minute (CWPM) for both descriptive and imaginative texts of grade V. Students who read both texts with 80% comprehension are plotted here. The mean of CWPM of two texts is calculated and shown on the 'Y' axis.

It is found that students who read the text with 80% comprehension had a median of 68 CWPM whereas lower 25% students read 54 CWPM or less and upper 25% students read 83 CWPM or higher. It is also evident from the figure that the minimum CWPM with 80% comprehension was 40 from which it can be inferred that the minimum level of oral reading fluency is 40 CWPM with 80% comprehension for grade V.

Findings

The major findings are:

- For grade III, the students who can read 46 Correct Word Per Minute (CWPM) of grade-level text with 80% comprehension could be labeled as fluent readers for the Bangla language. That is why it is recommended that the reading fluency benchmark for grade III students in Bangla is 46 CWPM.
- For grade V, the students who can read 54 Correct Word Per Minute (CWPM) of grade-level text with 80% comprehension could be labeled as fluent readers for the Bangla language. That is why it is recommended that the reading fluency benchmark for grade V students in Bangla is 54 CWPM.

Recommendations

- Using this benchmark, a baseline study is needed to identify the present situation of students' reading fluency of Grade III and Grade V. Necessary interventions should be taken based on the baseline study to achieve the targeted benchmark.
- A year-wise situational analysis study needs to be conducted to measure the level of students' achievement to compare with the benchmark and choose the appropriate interventions for achieving the targeted CWPM.
- The initiative is needed to conduct a comprehensive study for setting the benchmark for Grade I and Grade II.
- It needs to update the reading fluency benchmark periodically, following the context of students' learning needs.

Conclusion

This national-level study was done with the prior permission of MoPME. For the first time, the reading fluency benchmark is set for grade III and grade V. the teachers needed to know the standard reading fluency rate to assess their students' language learning progress. This study finds that at present major part of the students are below the standard level. So, it is essential to take the necessary steps by following the recommendations of the study immediately.

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Impact of Instructional Games on Students' Learning Achievement in Mathematics at Primary Level in Bangladesh

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Abstract

The study explored the effect of instructional games on students' learning achievement in mathematics at the primary level in Bangladesh. A quasi-experimental research design (both pretest & posttest) was followed to conduct the study. The study applied the instructional game's method for the experimental group and the conventional lecture-based method for the control group. An achievement test tool was developed and the same tool was used to conduct the pretest and posttest in both the experimental and control group. The primary data of the study were analyzed using descriptive and inferential statistics (mean, SD, t-test) to test the hypotheses. The study resulted that the learning achievement of experimental group students was significantly better than the control group students after four weeks of the intervention. The findings of the study indicate that the instructional game's method is significantly better than the conventional lecture-based method in terms of achieving learning outcomes in mathematics at Grade I. However, the study has made some recommendations based on the findings to apply the instructional game's method as one of the core methods for teaching and learning mathematics at the primary level in Bangladesh.

Keywords: Instructional Games, Learning Achievement, Mathematics, Primary Level, Bangladesh

Background of the Study

Games are one of the pristine forms of human activities. Studies suggest games are an essential part of every child's life and very vital for their proper physical, mental, and social development. Recently, children and adolescents have been spending most of their time playing electronic games. In this regard, Kapp (2012) mentioned that today's teenagers and adolescents devoted an extensive amount of their spare time online.

Instructional games have become an amazing mode for both entertainment and education. However, McLaren, Adams, Mayer, and Forlizzi (2017) revealed that the interest in computer-based instructional games is now well recognized and increasing day by day.

In recent years, the curiosity in examining the effectiveness of games in learning has increased. Mayer (2014) also indicated that recent studies have emphasized playing games and learning. Nowadays, application-based games have connected the worlds of gaming, amusement, and education in an attempt to deliver exciting as well as useful learning. The widespread recognition of instructive computer games and the prospects of game-based learning has boosted attention in the usage of instructional games in learning (Smith, 2010). However, the advancement of technology made it easy to play games on different platforms like smart phones or tabs for those who do not have a personal computer (Mitchell & Savill-Smith, 2004). Moreover, the nature of instructional games fits better with students' customs and curiosity (Prensky, 2001). Additionally, instructional games are considered as an efficient instrument for teaching hard and complicated subject like mathematics and science due to using action instead of description, creating personal motivation and pleasure, accommodating different learning approaches and skills, reinforcing mastery skills and providing collaborative and decision-making context (Charles & McAlister, 2004; Holland, Jenkins, & Squire, 2003).

Being one of the core subjects, minimal learning achievement in mathematics at the primary level has always been a major concern in Bangladesh. Arguably a significant number of the students consider it tough to understand the basic concepts of mathematics and often failed to achieve expected learning outcomes in mathematics. National Student Assessment (2017) report revealed that 97% of the students of grade 3 and 83% of the students of grade 5 failed to achieve all the competencies related to mathematics. However, the performance of secondary level students in mathematics is also low due to their weakness in basic mathematical skills from the beginning of the primary level. In this regard, Morshed (2013) explored that secondary level students' achievement in mathematics was the lowest among all the subjects. On the other hand, a study revealed that children aged 8-18 years play digital games on average 8 hours per week (Rideout et al., 2010). Although no scientific study showed any percentage on the rate of child users or spent time on the digital game, different recent news gave a probable indication of its growing popularity in Bangladesh. It is essential to utilize this phenomenon towards effective learning as studies revealed that games helped to foster children's learning achievement in several areas of math including problem-solving and algebra capacities (Abramovich, 2010), tactical and intellectual abilities (Bottino, Ferlino, Ott, &Tavella, 2007), critical geometry capacities (Yang & Chen, 2010), and arithmetic processes (Moreno & Duran, 2004). In this study, the researchers tried to contribute to the literature by investigating the effect of instructional games on students' learning achievement in mathematics at the primary level in the context of Bangladesh.

Statement of the Problem

A considerable number of multimedia equipments had been placed in the primary schools due to the recent initiatives taken by the government of Bangladesh of integrating ICT in the classroom teaching-learning process but a typical lecture-based teaching-learning method is still being carried out in the primary schools. Prensky (2001) also mentioned that the educational system did not change much with the radical change within the students. However, According to Gross (2007), it is really important to change the teaching-learning method with the advancement of technology to enhance the necessary skills that future citizens will require in a digital society. Nowadays, a large number of students faced difficulties to understand the basic concepts of mathematics. As a result, at the end of the primary level, they often fell short to achieve the required competencies in mathematics. According to National Student Assessment (2017) report, only 3% of students of grade 3 and 17% of students of grade 5 had achieved all the competencies related to mathematics. Therefore, it is needless to say students deserve a better teaching-learning method than the conventional lecture-based method that will help them to achieve necessary competencies related to mathematics. Thus, this study will examine the effect of instructional games on students' learning achievement at the primary level in Bangladesh.

Objectives of the Research

The specific objectives of the study were:

- to examine the impact of instructional games on students' learning achievement in mathematics of the experimental group.
- to identify the difference between the posttest mean score of the experimental group and the control group.
- to explore the effect of instructional games on gender among the participants of the experimental group.

Hypotheses of the Study

H_{01}: There is no significant difference between the pretest mean score and posttest mean score of the experimental group.

H_{02}: There is no significant difference between the posttest mean score of the experimental group and the control group.

H_{03}: There is no significant difference between the posttest mean scores of boys and girls of the experimental group.

The rationale of the Study

Nowadays, the curiosity of using instructional games forthe educational purpose has been increased. Excitement about learning through instructional games has been perceptible in the modern era which helped to develop many instructional games. Both Vygotsky and Piaget assumed about children acquire knowledge via play and/or games. In recent years, McLaren, Adams, Mayer, and Forlizzi (2017) revealed that a mathematical instructional game can deliver greater learning opportunities and be more engaging. Prensky (2001) argued that children, raised playing video games, learn better through digital instruction rather than conventional instruction.

Low mathematics achievement, particularly at the primary level, has always been a major concern in Bangladesh. McLaren, Adams, Mayer, and Forlizzi (2017) explored that a computer-based instructional game is significantly better than a conventional approach in terms of promoting mathematics learning. However, to the best of my knowledge, no scientific study had been conducted yet in Bangladesh to justify the effectiveness of instructional games on learning achievement in mathematics. This is why the study examined the effect of instructional games on students' learning achievement in mathematics at the primary level in Bangladesh.

Review of Related Literature

An instructional game is a learning tool that is tailored to a classroom, small group, or an individualized focus upon a particular content area or topic. These games consist of fun, interactive and engaging visuals that stimulate learning. In addition, it promotes learning and includes encouragement for the students to complete the task. According to Roblyer and Doering (2010), Instructional games are software products with game-like instructions and contest to learning activities.

Ahmad, Shafie, and Latif (2009) stated that teachers might present math in such a fun and meaningful way, the students may find mathematics interesting and get motivated to learn and study it. Many educators presented games as a useful learning instrument for the instructions that assist mathematics classrooms (Gough, 1999). Instructional games were considered as an efficient learning tool for different causes (Rosas et al., 2003). Egenfeldt-Nielsen (2005) claimed that instructional games facilitate learning through simulating the real environments and conducting activities that provide chances for the learners to learn. In addition, Koc (2005) described games as a successful way to introduce new mathematics content and new lessons.

Ibrahim and Hamid (2017) noticed significant effects of interactive video games on improving learners' mathematics achievement. Again, while intervening game-based learning approach in the subject of mathematics at the elementary level, Libradilla, Teves, and Teves (2015 explored that the achievement of the participants of the experimental group was better than the achievement of the participants of a controlled group. Furthermore, Al-Mashaqbeh and Al-Dweri (2014) in their experimental study observed that the experimental group achieved notably better in the posttest than the participants of the control group while investigating the effects of educational math games on first-grade learners' achievement in mathematics. A similar result was reported by Taclay (2013) in his quasi-experimental study where the participants of the experimental group who got math game-based learning as intervention obtained higher achievement scores compared to the participants who received the conventional method of teaching mathematics. In addition, Bai et al. (2012) also observed the significant effects of instructional games on increasing learners' mathematics achievement in grade eight.

Kebritchi, Hirumi, and Bai (2010) found a significant positive effect of computer games on learners' mathematics achievement while examining the effect of a computer game on students' mathematics achievement. Papastergiou (2009), in his experimental study, explored that the game was evenly motivational for both the boys and girls. However, Kim and Chang (2010), in their quantitative study of examining the effectiveness of digital math games at grade 4, observed a higher mathematics achievement level for the boys than the girls. Nevertheless, Mitchell and Savill-Smith (2004) observed both negative and positive effects of instructional games on learners' school performances. The students

who frequently played the game developed a comparatively less positive attitude toward school. On the positive side, students' spatial and cognitive skills were developed and they were ready for a computer-oriented society simply by playing games.

With the numerous studies, scholastic articles, journals conducted and written by different researchers and writers, the utilization of the instructional games method has its potential in motivating and engaging students in lessons. It is amusing and exciting, without the added stress, and the chance to reform the mistakes committed during game-play will make students become engaged in lessons presented by the teachers. The use of different senses while playing these instructional games makes the learning of students easier and brings a new perspective on how learning should be. Thus, the purpose of introducing instructional games is not focused on entertainment but rather on learning innovatively as instructional games optimize and enhance the learning potential of every learner. After a broad review of existent literature, the researchers concluded that instructional games may be applicable as an adjunct not only to mathematics but rather to all different subjects and disciplines.

Methodology

A quasi-experimental design was selected to conduct the study because the researchers couldn't assign the students randomly to the groups in the school setting. Two existent sections of grade I of Udayan Higher Secondary School were selected purposively to experiment. Data were collected through a quantitative approach and only primary data was elicited for the study. Researchers experimented with providing intervention by the researcher-participatory approach. Both application and activity-based mathematical instructional games were used as the intervention for the experimental group while experimenting. An achievement test tool was developed on addition (Chapter 12, Mathematics, Grade I) for both the experiment and control group to determine learners' previous knowledge. After the pretest, the experimental group received instructional games as an intervention while the control group was treated with the conventional lecture-based method. After four weeks of the intervention, a posttest was taken using the same achievement test tool to measure the difference of learning achievement in mathematics between the Experimental Group (EG) and the Control Group (CG).

Table 1: Quasi Experimental Pretest & Posttest Study Design

Groups	O-1	X	O-2
Selected Experimental Group	Pretest	Instructional Games (Treatment)	Posttest
Selected Control Group	Pretest	Conventional Method (No Treatment)	Posttest

Population, Sample, and Sampling

All the students of grade I of all the primary schools in Bangladesh were the population of this study. However, in this study two sections of grade, I of Udayan Higher Secondary School were purposively selected as sample groups. Total one hundred students (50 students from each section) were drawn as a sample from two intact sections named 'Maloti' and 'Mohua' of grade I from 'Udayan Higher Secondary School'. Section

'Mohua' was selected as 'Control Group' and Section 'Maloti' was selected as 'Experimental Group' purposively.

Data Analysis

The primary data were mainly analyzed through quantitative analysis using SPSS. All the students of both experimental and control groups had participated in both the pretest and posttest. The obtained marks of the participants from the achievement tests were analyzed through descriptive and inferential statistics and the data were presented through tables. An independent t-test was employed to determine if a significant difference existed by comparing the mean scores of the pretest and the posttest between the experimental and control group. The t-test scores were calculated for both experimental and control groups to accept or reject the hypotheses for the study. The hypotheses were tested at the 0.05 significance level.

Test of Hypotheses

H_{01}: There is no significant difference between the pretest mean score and posttest mean score of the experimental group.

Table 2: Difference between Mean Score of Pretest & Posttest of EG

Paired Samples Test							
			Paired Differences				
Score	Mean	Std. Deviation	Mean	Std. Deviation	T	Df	Sig. (2-tailed)
Pretest Score of EG	23.70	8.560	-16.400	5.806	-19.972	49	.000
Posttest Score of EG	40.10	6.585					

The difference between the pretest mean score (23.70) and posttest mean score (40.10) of the experimental group clearly shows that the experimental group has improved in terms of learning achievement in mathematics after getting instructional games as an intervention. The t-test results (Table 2) reveal a significant difference between the achievement mean score of pretest and posttest of the experimental group as the computed p-value of 0.000 had a lower value as compared to a p-value of 0.05 at 95% confidence interval ($p=0.000$, $p<0.05$), making the finding statistically significant. Thus, the t-test results claim that the first null hypothesis is rejected. Therefore, the results reveal that the participants of the experimental group have achieved better learning outcomes in mathematics after getting instructional games as an intervention.

H_{02}: There is no significant difference between the posttest mean score of the experimental group and the control group.

Table 3: Difference between Posttest Mean Score of CG & EG

Independent Samples Test									
Posttest scores of Control Group & Experimental Group					Levene's Test for Equality of Variances		t-test for equality of means		
					F	Sig.	t	df	Sig. (2-tailed)
Name of Groups	Mean	Std. Deviation							
Experimental Group	40.10	6.585	Posttest Score	Equal variances assumed	7.527	.007	5.921	98	.000
Control Group	30.60	9.238		Equal variances not assumed			5.921	88.572	.000

Data indicate that the experimental group's posttest mean score (40.10) is better than the control group's posttest mean score (30.60). It reveals that the learning achievement of the experimental group in the posttest is better than that of the control group. Furthermore, the observed t-value (5.921) is greater than the critical t-value (1.96) at 95% confidence interval. The computed p-value of 0.000 had a lower value as compared to a p-value of 0.05 as a margin of error ($p=0.000$, $p<0.05$), making the finding statistically significant. Thus, there is every evidence to reject the second null hypothesis. Therefore, the results reveal that the instructional game's method is more effective compared to the conventional lecture-based method in teaching mathematics at the primary level in Bangladesh.

H_{03}: There is no significant difference between the posttest mean scores of boys and girls of the experimental group.

Table 4: Difference between Mean Score of Boys & Girls of EG

Independent Samples Test of Experimental Group										
Posttest Score				Experimental Group		Levene's Test for Equality of Variances		t-test for Equality of Means		
						F	Sig.	t	Df	Sig. (2-tailed)
Gender	N	Mean	Std. Deviation							
Boy	25	40.60	6.344	Posttest Score	Equal variances assumed	.677	.415	.533	48	.596
Girl	25	39.60	6.910		Equal variances not assumed			.533	47.654	.597

Data reveal that the difference between the posttest mean score of boys (40.60) and girls (39.60) in the experimental group is very minimal. It also indicates that the computed

t-value (0.533) for the posttest is lower than the critical t-value (2.012) at 95% confidence interval. Furthermore, the computed p-value (0.596) is higher as compared to p-value (0.05) as a margin of error ($p=0.596$, $p>0.05$), making the finding statistically non-significant. That means there is no sufficient evidence to reject the third null hypothesis. Therefore, the results reveal that the use of the instructional game's method has no gender effect on the students. So, the implication is that the instructional game's method is equally effective for both boys and girls at the primary level in Bangladesh.

Major Findings

The key findings of the study from the results of the hypotheses test are summarized as follows:

- The usage of instructional games for teaching-learning math at the primary level in Bangladesh was helpful to improve participants' learning achievement in mathematics.
- The usage of the instructional game's method was significantly better than the conventional method in terms of learning achievement in mathematics at the primary level in Bangladesh.
- The usage of instructional games for students' learning achievement in mathematics was equally effective for both boys and girls at the primary level in Bangladesh.
- The instructional games method helped the students to improve their learning achievement in almost every phase of Bloom's knowledge domain. For instance, knowledge, understanding, application, and analysis-based test items.
- The instructional games method was also useful for managing classrooms at the primary level.

These findings suggest that usage of instructional games might be an effective way for teaching and learning mathematics at the primary level in terms of comparatively better learning achievement in mathematics.

Discussion

The study intended to investigate the impact of instructional games on students' learning achievement in mathematics at the primary level in Bangladesh through conducting a quasi-experimental design. The results of the hypotheses revealed that the mathematics achievement in the experimental group had been improved for using the instructional game's method for teaching mathematics at grade I. It was reflected positively towards students' learning achievement in mathematics. The results of the study indicate that the instructional game's method is significantly better than the conventional methods in terms of mathematics achievement at the primary level in Bangladesh. The key findings of the current study support several findings of previous studies (Al-Mashaqbeh & Al-Dweri, 2014; Ibrahim & Hmaid, 2017; Libradilla, Teves, & Teves, 2015; Taclay, 2013).

The findings of this study further disclosed that the instructional game's method was equally effective for both boys and girls in terms of mathematics achievement at grade I of primary schools in Bangladesh. A similar result was reported by Katmada, Mavridis, and Tsiatsos (2014) in their study claiming the games as an efficient learning tool for all the participants, regardless of gender. However, this finding of the study is inconsistent with

the finding of Kim and Chang (2010) study where they observed a higher mathematics achievement level for the boys than the girls.

From the above discussion, it can be deduced that the instructional game's method might be successfully included and applied by the teachers as an effective alternative method for teaching mathematics at the primary level. These findings suggest that the learners tend to accept and appreciate the instructional game's method due to the joyful learning activities. Thus, the instructional game's method could be an appropriate method for teaching-learning mathematics at grade I of primary schools in Bangladesh.

Recommendations

The following recommendations have been suggested based on the findings of the study to ensure learners' better mathematics achievement at the primary level in Bangladesh:

- The result of the study recommends to the educational policy makers and curriculum review/reform committee members to integrate the instructional game's method as one of the core teaching-learning methods for mathematics at the primary level in Bangladesh.
- The hypothetical test results recommend to the parents of the students to encourage their children to play various mathematical instructional games in their leisure time to learn mathematics through fun and recreation.
- The study recommends to the respective authorities to take necessary measures to develop proper age and class-based mathematical instructional games according to the primary mathematics curriculum and textbooks of Bangladesh as there is a lack of proper age and class-based mathematical instructional games according to the context of Bangladesh.
- The study suggests using the instructional game's method frequently to ensure gender equity in learning mathematics in the classroom as it is equally effective for both boys and girls.
- The study recommends applying the instructional game's method to teach math at the primary level in Bangladesh to motivate students and learn mathematics through fun activities.

Implications of the Study

The study described the impact of instructional games on students' learning achievement in mathematics at the primary level in Bangladesh. It has become apparent through the evaluation process that the instructional games might be integrated into the classroom teaching-learning activities for the students' better mathematics achievement at the primary level. The study will help the curriculum review/reform committee to decide on including instructional games as one of the core methods for teaching and learning mathematics at primary level in Bangladesh. The study will further motivate and guide the primary mathematics teachers to integrate instructional games methods into the classroom settings for effective mathematics teaching. Moreover, it could be used for blended learning considering certain extensions. The study will also motivate and guide future researchers to conduct their studies in the related research field. Finally, the study will motivate the game's developer to develop mathematical instructional games according to the primary mathematics curriculum and textbook in the context of Bangladesh.

Limitations of the Study

Some of the limitations of the study are discussed herewith:

- The study was conducted on a small scale. The sample of the study was limited to one hundred students of one primary school, the topic was limited to only "addition" of the mathematics textbook of grade I and the duration of the study were of only one month.
- The total time for conducting each test was about 40-45 minutes. Since the pretest and posttest were conducted in a short span of time, it's difficult to claim whether instructional games would facilitate long-term knowledge retention or not.
- Instructional games, used in the study were adopted from other countries as proper instructional games for teaching and learning mathematics couldn't be found in the context of Bangladesh.

Conclusion

Any generalizations drawn from the study should be considered with caution as the duration of the experiment was of only four weeks with the sample of only 100 first-grade students covering only 'Addition' topics from the curriculum. The main objective of the study was to examine the impact of instructional games on students' learning achievement in mathematics at the primary level in Bangladesh. Two intact groups were selected purposively as control and experimental group to conduct the study. A pretest and posttest were conducted through an achievement test to collect the achievement score from the participants of both groups. The experimental group had a 16.40 increase from pretest to posttest after getting the instructional game's method as an intervention while the control group had only a 6.20 increase from pretest to posttest with the conventional lecture-based method. The analysis and interpretation of the data revealed that the instructional game's method had a significant impact on learners' learning achievement in mathematics for grade I, students. It was also found that the instructional game's method was equally effective for both boys and girls.

All the findings of the study support that the instructional game's method is significantly better than the conventional lecture-based method in terms of learning achievement in mathematics. It was obvious from the investigation that the instructional game's method has the full potential to motivate students to understand and learn the basic concepts of mathematics in a better manner through fun activities. Therefore, the instructional game's method might become an essential part of modern teaching methods and tactics for teaching mathematics at the primary level in Bangladesh.

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Progress and Problems of Primary Education in Bangladesh: A Snapshot of 50 Years

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Abstract

Bangladesh is celebrating its golden jubilee of independence in 2021. This South Asian country has been struggling for ensuring equitable, compulsory, and free primary education since the British period. The main objective of this paper is to explore the progress and constraints of primary education in Bangladesh for the period of 1971 to 2020. This study was conducted following the documentary research method. The secondary data was collected from different personal and official documents. Following the data-driven thematic analysis, it is found that the number of schools, students, and teachers was expressively increased in the last 50 years in Bangladesh. Girls' access increased more than 20%, and the ratio of female teachers boosted 58.2% in primary schools. Moreover, the enrollment rate amplified more than 45%, where the dropout rate drastically decreased by 61% from 1976 to 2020. The education policies had some good suggestions for ensuring the progress of primary education. However, some of the recommendations have not been implemented yet. This study introduces a progress evaluation framework for analyzing the educational progress of developing countries in Asia and Africa.

Keywords: Primary Education, Policy, Progress, Bangladesh, Development

Background of the study

Bangladesh, a South Asian country, achieved independence through massive bloodshed from Pakistan in 1971. It has a long history of discrimination in primary education from the British to the Pakistan period. During the British period (1757-1947), Bangla (now Bangladesh) was lagging behind the region of the British Emperor, where the first steps towards universal primary education took place by accepting the Bengal primary education act 1930 (Mizan & Rahman, 2014). Similarly, in the Pakistan period (1947-1971), East Pakistan (now Bangladesh) faced regional discrimination towards primary education. As Asadullah (2010) stated that "the total number of primary schools in East Pakistan declined, leading to overcrowding of existing schools and classrooms" (p. 1).

Currently, Bangladesh is following the colonial education system (Mizan & Rahman, 2014) as a legacy of the British colony. Mainly, three streams of education are primary,

secondary, and tertiary education. Primary education has been treated as basic education in Bangladesh since its birth as a provision of constitution article-17. It is mentioned as equitable, free, and compulsory for all school-aged children (The Constitution of the People's Republic of Bangladesh, 1972). It has five years of education cycle with fifteen types of schools (Directorate of Primary Education, 2019). The Ministry of Primary and Mass Education (MoPME) played a leading role in managing primary education. However, the Ministry of Education (MoE) worked as a key stakeholder for formulating and taking new education policy.

During the last 50 years, several education policies have been taken to reform the education system in Bangladesh. In 1972. the first education commission was introduced, entitled "Bangladesh Education Commission", headed by Dr Quadrat-I-Khuda. He and his team submitted the final report in 1974. After four years of the first education commission, a new education policy was formed with the help of the National Education Advisory Committee in 1978 entitled "Interim Education Policy". In 1983, another education commission was formed named "Education Policy and Management Commission" headed by Dr Majid Khan (Islam, 2003). The third education commission was formed in 1988 called the "Bangladesh National Education Commission", led by Dr Mafizuddin Ahmed. In 1997, the Government of Bangladesh constituted a 56-members education commission headed by Dr M Shamsul Haque, the fourth education commission in Bangladesh. Then a six-member committee headed by Dr Nazrul Islam was formed in 1997, and they submitted a report in 2000 entitled "National Education Policy-2000'. Another education commission was introduced to identify immediate implementable reforms of the education sector in 2001 headed by Dr M. Abdul Bari (Islam, 2003), known as the Bari commission. In 2003, a new education commission entitled "National Education Commission" was initiated. The head of that Commission was Dr Mohammad Moniruzzaman Miah. He and his team submitted a report in 2004. Finally, the present education policy was taken in 2010 entitled "National Education Policy-2010", though the committee was formulated in 2009 headed by Dr Kabir Chowdhury. Now Bangladesh Education Policy-2010 is the first education policy ever to work for ten or more years continuously. In the last 50 years, eight more education policies were prepared, whereas these policies remained unimplemented (Ministry of Education, 2010). Due to adopting different policies in the last five decades, the primary education of Bangladesh has not been able to set a holistic child development approach with tracking its progress and problems.

The rationale of the study

As Nelson Mandela said- 'Education is the most powerful weapon to change society'. Education helps increase gross domestic product (GDP), life expectancy and reduce poverty, early marriage, mortality, and morbidity rates. According to Reddy & Rao (2003), "education is directly associated with the gross domestic product, indirectly with poverty, population growth, health and crime rate" (p.1242). Mainly, primary education played a key role in building an illiteracy-free country and active citizen for society. In the last 50 years, Bangladesh has passed through consistent instabilities in politics and educational development. In 2021, Bangladesh is celebrating its golden jubilee of independence from Pakistan. During this period, this paper will create an opportunity for policymakers, researchers, and academics to review the progress and problem of primary education, which will help them to rethink future education.

This is the first attempt in Bangladesh to review primary education for the long period of 1971 to 2020 systematically. As per sustainable development goals (SDGs), Bangladesh must ensure quality primary education for all within 2030. This paper also helps the

MoPME and policymakers to identify the appropriate work ways to achieve SDG4. Moreover, this paper will introduce a progress analysis framework (PAF) for measuring the growth of education following some evidence, implications, and messages for policymakers, researchers, and academics in Bangladesh and for Less Developed Countries (LDCs) or Developing Countries.

Theoretical framework

The progress of education was analyzed in multiple ways in developed and developing countries. Several studies were conducted around the world. Firstly, a study was conducted in the USA for measuring the national progress in education by looking at the changes in data over time- like the number of schools, enrollment rate, school attendance, pupil teachers ratios, student assessment, source of revenues for schools, and expenditures per pupil (Snyder, 1993). Secondly, a study was conducted in India for evaluating the progress and constraints of primary education through analyzing the trends of literacy rate (urban-rural disparity and gender-social disparity), access to primary education (density of primary schools and enrollments vis-a-vis dropouts), expenditure on education (total expenditure, share of primary education in the budget, and expenditure per student), policy initiatives and implications (Reddy & Rao, 2003). Thirdly, another study was conducted in Ghana for assessing the educational progress and challenges of 50 years which tried to analyze the vision of education at the time of independence as a beginning stage, analyze the changes throughout the late 1960s to the mid-1980s as a shifting stage and analyze the late 2000 initiatives as reforming stage of education in Ghana (Akyeampong, 2010).

After reviewing these indicators, the author developed an analysis framework to analyze the progress and problems of primary education in Bangladesh. Three major areas are 'policy direction' from the independence, 'financial allocation' for smooth implementation, and 'numeric progress' over the period. These major areas have been analyzed through different indicators mentioned below the figure-1.

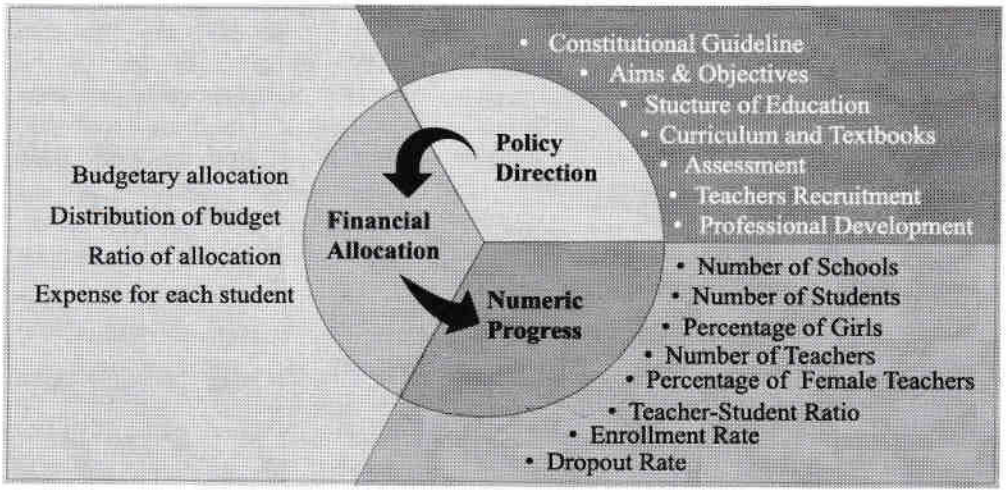

Figure 8: Progress Analysis Framework (Developed by author)

Objectives of the study

The main objective of this paper is to explore the periodical progress and constraints of primary education in Bangladesh for the period 1971 to 2020. The specific objectives of this paper are:

a) to explore the policy direction for ensuring free, equitable, and compulsory primary education in Bangladesh for the period 1971 to 2020.
b) to analyze the trends of financial allocation for primary education of the last five decades in Bangladesh.
c) to identify the numeric development of primary education in the last 50 years in Bangladesh.

Methodology

This study was conducted following the principles of the documentary research method. According to Scott & Marshall (2015), documentary research mainly uses personal and official documents as materials. It may comprise secondary sources like newspapers, diaries, stamps, directories, handbills, maps, government statistical publications, photographs, paintings, gramophone records, tapes, and computer files.

The policy-related data was collected from different laws, education policies/ commissions like- the Constitution of the Peoples' Republic of Bangladesh, Bangladesh Education Commission report 1974 (BEC74), Interim Education Policy report 1978 (IEP78), Education Policy and Management Commission report 1983 (EPMC83), Bangladesh National Education Commission report 1988 (BEC88), National Education Policy-1997 (NEP97), National Education Policy-2000 (NEP2000), Education Commission report 2001 (EC01), National Education Commission report 2004 (NEC04), and the National Education Policy-2010 (NEP10). The Compulsory Primary Education Law-1990 and other related laws have been analyzed thematically to meet the research objectives.

Besides, the financial allocation was analyzed based on the budgetary distribution of the last 50 years. These data were collected from the Ministry of Finance (MoF). Moreover, the numerical progress of primary education was analyzed based on statistical reports of the Bangladesh Bureau of Educational Information and Statistics (BANBEIS) published from 1970-71 to 2020. Besides, some data were collected from the World Bank Data Center, UNESCO Data Center, Ministry of Primary and Mass Education, and the Ministry of Education.

Finally, the collected data were verified from different sources and analyzed to follow the data-driven thematic approach suggested by Braun and Clarke (2006).

Result

The findings of this paper are presented thematically, maintaining the sequence of research objectives. Firstly, the policy directions for ensuring free, equitable, and compulsory primary education in Bangladesh from 1971 to 2020 related significant findings will be presented under sub-themes. Secondly, the budgetary allocation of the last five decades will be illustrated based on the second objectives of this paper. And finally, the numerical progress of primary education in Bangladesh will reveal thematically from 1971 to 2020. Mainly, the periodical progress and constraints of primary education in Bangladesh will be explored based on the progress analysis framework (figure:1).

Policy Direction

After independence from Pakistan in 1971, Bangladesh started its long-awaited journey under the leadership of Sheikh Mujibur Rahman, and he introduced a new constitution in 1972. That constitution set a guideline for education that reflected later for formulating education policies. In the last 50 years of Bangladesh, all education policies identified aims and objectives, education structure, the basic component of curriculum and textbooks, assessment strategies, teachers' recruitment process, and professional development guidelines for primary education.

Constitutional Guideline

In 1972, the Constitution of the People's Republic of Bangladesh identified free and compulsory education as fundamental principles of state policy. This policy illustrated that "the state shall adopt effective measures for –establishing a uniform, mass-oriented and universal system of education and extending free and compulsory education to all children to such stage as may be determined by law" (Constitution of the People's Republic of Bangladesh, 1972, p.6). As per the guideline of the constitution, the Bangladesh Education Commission-1974 (BEC74), Interim Education Policy 1978 (IEP78) and Bangladesh National Education Commission-1988 (BNEC88) gave suggestions to ensure compulsory primary education. However, it did not implement before establishing a law in 1990 called "Compulsory Primary Education Law-1990". The President of Bangladesh signed this law on 13th February 1990. In 1992 it was implemented as a pilot basis, and finally, in 1993, that law was effectively executed around the country.

Aims and Objectives

The aims and objectives of primary education depend on the overall aims and objectives of education. Similarly, education's overall aims and objectives depend on the 'fundamental principle of state policy. In the last five decades, seven education policies were formulated by the different governments at different regimes. These policies gave importance to developing the child physically, mentally, socially, spiritually, morally, humanely, and aesthetically and to inspire him/her to dream of a better life. However, the basic difference of aims and objectives of these policies was in a point that was "fundamental principle of the state policy". In 1972, the Constitution of Bangladesh identified 'secularism' as one of the four fundamental principles of state policy. But after the fifth amendment in 1979, a major change occurred in the fundamental principle of the state policy of constitution that was 'secularism' replaced with 'absolute trust and faith in the almighty Allah'. Though in 2011, the fifteenth amendment reestablished 'secularism' in the constitution.

Structure of Education

In different education policies tried to identify the duration of primary education either five years or eight years. The BEC74, BNEC88, the National Education Policy 1997 (NEP97), National Education Policy 2000 (NEP2000), and National Education Policy 2010 (NEP10) recommended for eight years of primary education whereas the IEP78 and National Education Commission-2003 (NEC03) recommended for five years of primary schooling. Now Bangladesh is practicing five years of primary schooling while the NEP10 stated that

> "…. the duration of primary education will be extended from Class V to Class VIII. This 8-year long primary education will be ensured for all children of the country, regardless of gender, socio-economic conditions,

> and ethnicity by 2018 through the implementation of appropriate methods" (Ministry of Education, 2010, p. 13).

In the last 50 years, Bangladesh could not move from five years of primary schooling to eight years.

Curriculum and Textbooks

In the last 50 years, all of these education policies emphasise modern, scientific, life-skill-based, and pre-vocational oriented primary education for the future generation. From 1971 to 2020, the curriculum and textbooks did not prepare as per suggestions of policies. All of these education policies are encouraged to teach the children in the mother tongue '*Bangla*'. Besides, '*English*' was identified as a second language that has to be learned from grade six (Ministry of Education, 1974 and 1988), grade three (Ministry of Education, 1997 and 2000), and grade one (Ministry of Education, 2003 and 2010). Now '*English*' is a compulsory subject at the primary level in Bangladesh from grade one.

There was another debate about faith-based education at the primary level. It has a close relationship with the aims and objectives of primary education and the fundamental principle of state policy. In different policies, faith-based education is acknowledged as an optional subject for the primary level (Ministry of Education, 1974). It could be compulsory from grade three (Ministry of Education, 1997 and 2000) recommended by different commissions. Besides, the NEC03 identified religious education as compulsory from grade two, whereas some policies recognized that faith-based education should be compulsory from grade one (Ministry of Education, 1978, 1988, and 2010). All seven education policies/commissions recommended that Bangla, Mathematics, Social Environment, and Science should have treated as basic subjects for the students of primary level in Bangladesh.

Assessment

Both formative and summative exams were prioritised in all education policies/ commissions. They mostly recommended a paper-pencil test from grades one to five for compulsory subjects and oral tests for other elective subjects. All of the education policies/ commissions had a suggestion to take 'primary education completing examination (PECE)' either centrally or locally. For example, a commission stated that a school-based examination should be taken through district-based questions at the end of grades five and eight. Students should be identified for a merit-based scholarship (Ministry of Education, 1974). Similarly, another policy told that "after completion of primary education, a final examination should be arranged under a separate primary education board and the certificate should be issued for students" (Ministry of Education, 1978, p.22). The latest education policy was also similarly recommended for PECE and stated that at the end of grade five, the Education Boards would take a terminal examination at Upazila/ Pourashava/ Thana levels (of big cities) with an identical set of questions (Ministry of Education, 2010).

Teachers Recruitment

Teachers' supply is an important issue for ensuring quality education. A commission stated

> "...if the highest qualified persons irrespective of male or female are not selected at all levels of teaching and if society fails to recognize the important role played by teachers in our national life, no education reform is ever likely to succeed" (Ministry of Education, 1974, p.172).

So, the standard of education partially depends on the standard of teachers. In the last 50 years, every education policy recommended meritorious and highly skilled teachers for primary schools. All the policies suggested increasing the number of female teachers at the primary level, and it was correctly implemented. Data showed that the percentage of female teachers increased by 48.2% in the last 50 years. Besides, a policy direction was to establish a separate teacher selection commission similar to the public service commission for selecting teachers at the primary level (Ministry of Education, 2010), while it was not implemented yet.

Professional Development

All education policies emphasize ensuring teachers' professional development after getting an appointment as a young teacher at the government primary schools. For example, a policy revealed, "immediately after their recruitment, primary teachers will undergo 2- months' foundation training" (Ministry of Education, 2010, p.65).

Mainly, Primary Teachers Training Institute (PTI) worked for providing teachers professional development related training as either Certificate in Education (C-in-Ed) or Diploma in Primary Education (DPEd). For example, a commission recommended upgrading PTIs as colleges and changing their curriculum by improving one-year-long courses to two years (Ministry of Education, 1974). Similarly, the recent policy wanted to improve the existing teacher education program and recommended

> "...the existing primary teachers training program is known as C- in- Ed will be revised and the duration of the new programs will be one year and a half instead of one. Modern strategies of teaching-learning and evaluation will be incorporated" (Ministry of Education, 2010, p.65).

Now 67 PTIs have been providing one and a half year-long (96 credit hours) DPEd program for primary school teachers since 2012. This training modality is in-service through a policy recommended that it be pre-service (Ministry of Education, 2003).

Financial Allocation

After starting a new journey in 1972, Bangladesh has prioritised the education sector for addressing education in the constitution, introducing a new education commission, and allocating 2.8% of the total budget in the primary education sector. Every education policy identified the financial issues and recommended allocating five to seven percent of total national income in the education sector and to spend 60% of the total education budget for primary education.

For example, the first education commission recommended to share 5% of the total national income in the education sector and to spend 60% of its' on primary education (Ministry of Education, 1974). Besides, the other education policies recommended sharing 7% of the total national income in the education sector (Ministry of Education, 1978 and 2010).

Budgetary allocation in 50 years

For implementing education policies in the last 50 years, Bangladesh allocated a minimum amount of money that was not more than 3% of GDP. Data shows that it was less than 1% of total GDP in the 90s though it reached nearly 2% in 2018 (UIS Statistics, 2020). The table-1 shows the overall financial allocation in primary education sectors from 1972 to 2020.

Table 2: Financial allocation in the primary sector in the last 50 years

FY	Expenditure *[In Million Bangladesh Taka (BDT)]*			% of allocation in primary education	Per Student Expenditure *(In BDT)*
	Revenue	**Development**	**Total**		
1972-73	181.9	41.1	223.0	2.8%	44
1980-81	939.9	239.0	1178.9	2.9%	142
1990-91	5385.0	1910.2	7295.2	5.0%	611
2000-01	13700.0	13540.0	27540.0	7.1%	1559
2010-11	48550.0	32070.0	80620.0	6.1%	4769
2020-21	155360.0	94040.0	249400.0	4.4%	12394

(Sources: Budget of FY 1972-73, 1980-81, 1990-91, 2000-2001, 2010-11 & 2021-22)

At the beginning of the birth of Bangladesh, in the Fiscal Year (FY) 1972-72, a total of 223 million BDT was allocated in primary education. In 1980-81 FY, 1178.9 million BDT was distributed in the primary education sector, reaching 7295.2 million BDT in 1990-91 FY. The amount of budget in the primary education sector was dramatically increased in the FY 2000-2001; the amount was 27540 million BDT. This allocation was increased nearly three times from FY 2000-01 to FY 2010-11. A total of 80620 million BDT was allocated for primary education in FY 2010-11. Finally, in FY 2020-21, a total of 249400 million BDT was allocated in the primary education sector that was three times more than FY 2010-11 and 1118.3 times more than the budget of FY 1972-73.

Trends of revenue vs development portion

The trends of revenue vs development budget were increased gradually over the period. The table:1 shows that most of the budget allocation goes to the revenue sector than the development sector. Mainly, the revenue budget spends as operating cost, whereas the development budget goes to infrastructure development. The allocation trends in the revenue sector were 81.6% in FY 1972-73 and 79.7% in FY 1980-81. At the same time, it was slightly reduced (73.8%) in FY 1990-91. The allocation between revenue and development budget was fifty-fifty in FY 2000-2001 though the revenue was moderately increased by 60.2% in FY 2010-11 and 62.3% in FY 2020-21.

Trends of allocation in primary education

The trends of allocation in the primary education sector show in Table:1 that in FY 1972-73, the proportion of primary education was 2.8% of the total budget, whereas it slightly increased by 2.9% in the budget of FY 1980-81. The allocation was gradually increased and reached 5.0% in FY 1990-91 and 7.1% in the FY 2000-2001 budget. Besides, the proportion of the primary education budget slightly decreased in FY 2010-11 that was 6.1% of the total budget. Currently, in the budget of FY 2020-21, the allocation of primary education was 4.4% of the total budget which indicates that was the least allocation of the last four decades.

Trends of per-student expenditure

Data shows (table:1) that per-student yearly cost gradually improved for the period 1971 to 2020. In FY 1972-73, a total of 44 BDT had been spent in a year for a student while it was 142 BDT in FY 1980-81 and 611 BDT in FY 1990-91. The amount of money crossed one thousand and five hundred BDT in FY 2000-2001 for a student in a year and reached 4 thousand in FY 2010-11. However, expenditure per student in a year intensely reached 12 thousand in FY 2020-21, which is the highest per-student expenditure over the period.

Numeric Progress

The last 50 years were a rising moment for Bangladesh in the education sector and other sectors. Economically, Bangladesh was recognized as an 'Emerging Asian Tiger" due to rapid growth where the workers played a key role. The table-2 shows that in 1970, the total population was 64.2 million though now it is 164 million. The growth of the population in the last fifty years was 156.7% which was driven to boost the numeric progress of education in Bangladesh. The table below presents the scenario of primary education in terms of numbers.

Table 3: Population distribution in the last 50 years

Year	Population (Million)	Age group (0-4)	Age group (4-6)	Age group (6-11)	Age group (12-18	Age group (18+	Median Age
1970	64.2	18.3	9.5	16.5	14.4	49.4	17.8
1980	79.6	17.4	9.2	16.7	16.6	48.4	17.4
1990	103.2	15.4	8.8	16.4	16.2	51.2	18.6
2000	127.7	12.8	7.5	14.6	16.0	56.3	21.0
2010	147.6	10.4	6.4	13.0	14.7	61.8	24.0
2020	164.7	8.7	5.3	10.8	13.1	67.6	27.6

(Source: Worldometer, World Population Prospects 2019)

After independence in 1971, Bangladesh numerically confirmed the progress in different areas including the number of educational institutions, students, teachers, the proportion of girls' student and female teachers, enrollment rates, and dropout rates. Behind this significant progress, the policy directions and financial allocations worked as a tonic for primary education in Bangladesh.

Table 4: Progress of primary education in 50 years

Year	Schools	Students	Ratio of Girls	Teachers	Female Teachers	Teacher Student Ratio	Enrollment Rate	Dropout Rate
1971	28,731	50,90,003	31.8	1,17,275	2.2	1:43	52.0	78.9*
1981	40,926	82,85,807	40.3	1,49,909	7.6	1:55	67.7	62.2
1990	45,917	1,19,39,949	44.8	1,89,508	19.4	1:63	83.8	60.0
2000	78,014	1,76,67,985	48.9	3,08,937	30.0	1:57	84.0	48.3
2010	82,674	1,69,04,546	50.5	3,80,957	45.6	1:44	94.8	39.8
2020	1,29,258	2,01,22,337	51.1	7,21,801	60.4	1:28	97.3	17.9

(Source: BANBEIS, 1984; BANBEIS, 1981; BANBEIS, 1990; BANBEIS, 2000; BANBEIS, 2010; BANBEIS, 2020; World Bank Data Center, 2020; UNESCO Data Center, 2020, Ministry of Primary and Mass Education, 2010; and Ministry of Education, 2014; *Dropout rate in 1976)

Number of Schools

The number of primary schools had increased gradually from 1971 to 2020. Data shows that there were nearly 29 thousand schools in 1971, these numbers reached around

41 thousand in 1981. The number of schools increased slightly from 1981 to1990 that was around 46 thousand. In 2000, 78 thousand primary schools were operating while this number reached more than 82 thousand in 2010. In the last decades, nearly fifty thousand schools were included in the total list of primary schools. Now in Bangladesh, more than 129 thousand primary schools are functioning at the primary level of which 75 thousand schools are managed by the MoPME (Ministry of Primary and Mass Education, 2019).

Number of Students

At the time of independence in 1971, more than five million students were studying at the primary schools whereas it increased by three million after ten years in 1981. In 1990, nearly 12 million students were at the primary level and this number reached 17.6 million in 2000. Although, the number of students slightly decreased in 2010 from 2000, around 17 million students were at primary schools. In 2020, a total of 20.1 million students are studying at primary schools in Bangladesh, which is four times larger than the number of students in 1971.

Percentage of Girls

The table-3 above shows that gender disparity was one of the problems in 1971 due to the poor proportion (31.8%) of girls at primary schools. This scenario started to be changed in 1981, the ratio of girls reached 40.3% at primary schools. The proportion of girls at the primary level was gradually increased by 44.8% in 1990, 48.9% in 2000, and 50.5% in 2010. In 2020, more than half (51.1%) of the students of primary schools are girls.

Number of Teachers

The number of teachers was increased simultaneously with the number of schools for the last 50 years. In 1971, more than 117 thousand teachers worked at primary schools, which reached around 309 thousand in 2000. Recently in 2020, more than 722 thousand teachers have been working at primary schools in Bangladesh.

Proportion of Female Teachers

The table-3 above shows that the proportion of female teachers were significantly increased from 1971 to 2020. In 1971, the proportion of female teachers was 2.2% which marginally increased (7.6%) in 1981. The number of female teachers was gradually increased and the ratio of female teachers was 19.4% in 1990 that reached 30.0% in 2000. Mainly, the proportion of female teachers was highly improved in the last two decades that was 45.6% in 2010 and now it is 60.4% in 2020.

Teacher-Students Ratio

Data (table-3) shows the teacher-student ratio of the last 50 years. In 1971, the teacher-students ratio was 1:43 which also increased to 1:55 in 1981. In the 90s, this ratio reached at least point (1:63). The situation of the teacher-student ratio was gradually improved after the 90s. In 2000, it was 1:57 and in 2010 this ratio was 1:44. The teacher-student ratio is 1:28 in 2020, which improved around 65% in the last 50 years.

Enrolment Rate

Over the last five decades, Bangladesh faced numerous challenges to increase the enrolment rate. Data shows that nearly half of the children were out of school in 1971. One of the main challenges for a newly independent country was to improve the enrolment rate at the primary level. In 1971, the enrolment rate was 52.0%, reaching 67.7% in 1981 and 83.8% in 1990. After having taken a law on compulsory primary education in 1993, this rate was extended 84.0% in 2000 and considerably reached 94.8% in 2010. Now the

enrolment rate in Bangladesh is 97.3% which significantly increased by 45% from 1971 to 2020.

Dropout Rate

The dropout rate was one of the major challenges of primary education in Bangladesh for the last five decades. The dropout rate was 78.9% in 1976 which steadily decreased over the period. This rate was 62.2% in 1981, 60.0% in 1990, 48.3% in 2000 and 39.8% in 2010 respectively. Mainly, the dropout rate was considerably reduced from 2010 to 2020 which reached only 17.9% in 2020.

Implications

This study has different implications for the researchers, policymakers, and academics not only in Bangladesh but also in LDCs and other developing countries in Asia and Africa.

Implication for further research

Bangladesh showed enormous progress in the quantitative development of education in the last five decades after independence in 1971. In the last 50 years, the number of schools increased by 349.9%, the number of students also increased 295.3%, and the number of teachers significantly increased by 515.5%. Besides, the proportion of girls increased by more than 20%, and the ratio of female teachers boosted by 58.2%. Moreover, the enrollment rate amplified more than 45%, where the dropout rate significantly decreased to 61% over the period. The researchers explored the causes of such kind of vast development in the primary education sector in Bangladesh. Especially, they also explored how Bangladesh could make such huge progress in terms of the number of schools, teachers, students, enrollment rate, and decreasing dropout rate despite having 250 years' history of past discrimination.

It is expected that shortly, it will be possible to replicate this study in other developing countries or the LDCs for measuring their progress in primary education. The progress analysis framework will help them identify the indicators or add additional variables to analyze their progress. Broadly, the international donor agencies and development organizations may take initiatives to analyze the educational progress of multi-countries with similar socio-economic conditions like Bangladesh based on this analysis framework.

Implication for policymakers

Bangladesh took nine education policies /commissions in the last 50 years though no one could be implemented properly except the recent one taken in 2010. In all the policies, there were some good suggestions for ensuring progress and quality of primary education. Some of the recommendations have not been implemented yet like eight years of primary education cycle, learning-friendly assessment policy, independent teacher selection authority (like public service commission), primary teachers' training college, pre-service teacher education program, recruitment of motivated and meritorious teachers, allocate more than 5% of GDP and distribute more than 60% of the total education budget in the primary sector. This study helps the policymakers to take the necessary steps to mitigate the issues mentioned above.

Bangladesh tried to focus more on quality education in the last few years as mentioned in goal no four of the Sustainable Development SDGs). This study explored the quantitative progress of the last five decades where the quality issues were ignored in any way. Hence, this study presents an overall picture of primary education of Bangladesh to

the policymakers that will guide them to take required policies, initiatives, and measures for ensuring quality

Implication academics

'Progress and problems of the primary education in Bangladesh' is a burning issue for policy studies, international and comparative education studies, the foundation of education studies, and documentary research areas. The academics may use these study findings to describe how a less developed country showed massive progress in primary education with more than 20 million students in the classroom. It is an excellent example for LDCs and developing countries of Asia and Africa to compare the progress and problems in terms of quantity. Besides, this paper will also help the students who want to work in education sectors in the LDCs and developing countries in the coming days.

Conclusion

In the last 50 years, Bangladesh developed considerably in the primary education sector in quantitative development. Many developing countries treated Bangladesh as a role model for achieving unprecedented enrollment rates and reducing the dropout rate after promising MDGs. It could be possible for political steadiness since 2009, smooth financial allocation from 1990, and acknowledging the primary education sector as a prioritized area for human development. Besides, the quality of primary education remains a big challenge for Bangladesh. Nevertheless, it has been working after signing SGDs and moving forward to achieve quality through quantity. This paper will help the policymakers of developing countries identify the way forwards for achieving quality primary education.

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Pre-primary teachers' perceptions and beliefs about play-based pedagogy: A case study of a Sadar Upazila in Bangladesh

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Abstract

The research was undertaken to investigate the pre-primary teachers' perceptions and beliefs about play-based pedagogy in Bangladesh. In a case study design, a mixed-method was adopted to investigate the phenomena deeply: survey, semi-structured interviews and observations were employed in this study. All government primary schools of a Sadar Upazila in Bangladesh were selected where fifty-five pre-primary teachers were surveyed using questionnaires. Three pre-primary teachers were interviewed from three different schools and two pre-primary classrooms activities were observed. Findings indicated a complex scenario of teachers' perceptions and beliefs of play-based pedagogy in the case study of that Sadar Upazila of Bangladesh. It was found that all the pre-primary teachers valued play and considered play is important for children's learning and development. However, the study found that although teachers valued play in school settings and play-based learning, they had insufficient knowledge of play-based pedagogy. The study demonstrated that that teachers' insufficient knowledge and understanding of play-based pedagogy affect their practices. The study concludes with implications and recommendations to improve current practices and to achieve quality learning in pre-primary classes.

Keywords: pre-primary education; pedagogy; play-based pedagogy; play and learning

Introduction

The Bangladesh government introduced one-year Pre-primary Education (PPE) in the government primary schools for five to six-year-old children in 2010.A separate curriculum was developed for the PPE, which encompasses a child-centered, interactive and play-based approach as a pedagogy for the pre-primary class (National Curriculum and Textbook Board, 2011). Several commitments, strategies and goals stimulated the Bangladesh government and non-government organisations to establish and offer preschool education to include more disadvantaged groups (Shahjamal & Nath, 2008). Subsequently, the Bangladesh government introduced one-year pre-primary education. One teacher is appointed for the pre-primary class; the maximum number of children in a class is expected

to be 30 (MoPME, 2008). It is worth mentioning that before Non-government Organizations mostly conducted 2010 Pre-primary Education (NGOs), and still many pre-primary classes are run by the NGOs (UNESCO, 2015); at that time Non-government Primary Schools (which were nationalised in the year of 2013) were out of the PPE coverage. Gradually those schools have been incorporated into the PPE system and new Pre-primary teacher posts have been created. Although Pre-primary Education was launched in 2010 no formal curriculum was formulated at that time; instead, interim guidelines were developed to run the PPE programme. In June 2011 a separate Pre-Primary Education Curriculum was developed by NCTB.

Considering the Early Learning and Development Standards (ELDS), and in relation to the Bangladesh context, four domains of learning have been divided into eight learning areas in PPE. They are physical and kinesthetic, science and technology, social and emotional, health and safety, pre-math's, creativity and aesthetic, language and communication, as well as environment. The curriculum is considered to be play-based and interactive, and its philosophy is the holistic development of the child. There are provisions for both indoor and outdoor activities to foster children's learning. The pre-primary curriculum is underscored to create an enabling environment and plenty of opportunities for instilling a love for learning into the child. It also aims to tap into the child's spontaneous eagerness and curiosity (fundamental to intrinsic motivation for learning) to question and learn and help them acquire the attributes and knowledge they need for primary school and throughout their lives (NCTB, 2011). The curriculum includes a materials package that contains the teacher's guides, workbooks, exercise books, a Bengali alphabet chart, flip chart, flashcards (number, alphabet, and objects), storybooks, blocks, play materials, audio-visual materials, toolboxes, and children's attendance registers. The government supplies these materials to the children and teachers of all schools free of cost. Although the curriculum emphasises learning through play or play-based activities in PPE, in practice, a high teacher-child ratio and insufficient resources and facilities create a mismatch between policy and practice (Profeta, 2012; Nath et al., 2014).

The rationale for the study

Introducing PPE in government settings was imperative, but it was also challenging for the government. Although the government launched PPE, there is very little research-based evidence about current practices in pre-primary classrooms. Especially there is very little research on teaches' perception, views and understanding of play-based learning in the pre-primary classes. A pioneering study conducted by Chowdhury and RIvalland (2012) found that teachers incorporated play as a teaching and learning method and acknowledged it as enhancing young children's academic skills, but children are expected to imitate teacher-guided activities. Another study conducted by the Campaign for Popular Education (Nath et al., 2014) explored the practices in pre-primary classrooms. That study points out that teaching mainly was limited to achieving academic skills in Bengali and mathematics. Recitation of rhymes and drawing of various objects were also included. Activities like singing, telling stories or rhymes, play or drama were absent, and everything was book-based; there was no activity outside classrooms. The above studies prompted the researcher to undertake the current research as an insider researcher in this department.

Purpose of the Study

The purpose of this study was to investigate the teachers' perception and belief about play-based pedagogy and to identify practice-related issues. In the Effective Provision of Pre-school Education (EPPE) study Siraj-Blatchford (2010) found that a good grasp of the

appropriate pedagogical content knowledge was to be a vital component of pedagogy, and just as important in the early years as at any later stage of education. Also, pedagogical understanding makes a difference in practice and children's experiences (Stephen, 2010). Consequently, this study explores pre-primary teachers' concept of play-based pedagogy and how their conceptualisation influences their practices. To achieve this purpose, different aspects of pedagogy such as teachers' understanding of play-based pedagogy and classroom practices have been examined. Beyond this immediate function, it is also hoped that the findings and recommendations of this study may contribute to pre-primary policy formation in terms of instructional methods and teacher training models.

Conceptual framework

Play in the Early Childhood Curriculum

Research shows that the curriculum and content of early childhood education is a debatable issue. There are challenges to the ideology of early childhood education, which places the child is the heart of the education process, which demands a flexible play-based approach (Wood, 2008). Play and learning are inseparable in the early learning stage. As Nutbrown and Clough, (2014, p.153) describe "play is seen in relation to all aspects of a child's day, integral to and part of a holistic approach to early education and care for very young children." Wood (2008) indicates play is important for children's learning and development and is considered one of the fundamental principles of early childhood education. But for educationalists and practitioners, the most challenging thing is to define what play is (Nutbrown and Clough, 2014, Stephen, 2012; Theobald et al., 2015), and what is its educational value or "what does play do for the child?" (Wood, 2013). Additionally, play is influenced by the cultural setting and atmosphere (Bruce, 2010), and also childhood attitudes and to play, which is affected by social and economic circumstances (Whitebread et al., 2012). In this regard, Chowhdhury and Rivalland (2012) argued that before adopting a play-oriented pedagogical approach, it is important to consider that particular strategy and context.

In early childhood education, different curriculum models are practised across the globe. TeWhariki (New Zealand), Reggio Emilia (Northern Italy) and the High/Scope curriculum significantly influence early learning. TeWhariki is a locally originated bi-cultural curriculum that reflects Maori communities' cultural heritage, beliefs, and heritage (Wood, 2013). It encompasses the holistic development of children. Socio-cultural theories influence this model, and learning is defined as a co-constructive process. Spontaneous, free and structured play activities are valued as a key learning process. Practitioners have a meaningful role in children's learning during play and are expected to facilitate learning by careful intervention (Lewis and Thomas, 2016). Another enriched, child-centered curriculum (Soler and Miller, 2003) originated in Northern Italy with the Reggio Emilia approach. This approach focused on creative arts that can be expressed in multi-modal ways using various materials, tools, and resources (Wood, 2013). In this approach, using a variety of sources creates multimodal opportunities for play. However, there is no predetermined curriculum in the Reggio approach. Children's learning is developed through their involvement in long and short-term projects, which develop through first-hand experience and their theories about the world (Thornton and Brunton, 2015). Soler and Miller (2003) noted that Reggio Emilia is criticised for lacking accountability to the broader society because there is no written curriculum.

Role of Adults in preschool education

In the preschool curriculum, the adults' role is considered crucial for effective learning. Whether the activity will be teacher-directed or child-initiated and child-driven is a key issue in preschool pedagogy (Broadhead and Burt, 2012). Many researchers and practitioners argue that in child-centered play-based pedagogy, the child will initiate and run the activity, adults will support and "follow the children's interests" (Stephen, 2012; p.234). However, others believe that working together and balancing between teacher-directed activity and child-initiated activity in pre-school brings better results (Siraj-Blatchford and Sylva, 2004) and sustained shared thinking is necessary for the most effective pedagogy. Some practitioners, however, believe that for better achievement in mathematics and literacy, adult-guided activity is more important.

Importance of play

The importance of play is well established by research literature on early childhood education. Play is considered important throughout the world (Bruce, 2010). From research evidence, Moyles (2010) and Rogers (2011) confirm that play is the most powerful medium for learning in the early years. Bodrova and Leong (2015) indicate play as an efficient vehicle to deliver academic concepts and skills to preschoolers. Stephen (2012) states that play makes a decisive contribution to children's learning, a unique opportunity that allows children to learn and develop (Wood, 2014; Mclnnes, et al, 2011). Siraj-Blatchford et al. (2007) found that children actively seek challenges during play and are engaged in exploring, thinking, and learning.

Many researchers find that play facilitates children's physical, mental, emotional, intellectual, social development. Play also develops creativity and imagination among children. Play contributes to children's social, emotional, cognitive, and physical development (Burriss and Burriss, 2011).

Although play is considered essential for children's learning and development, there is still controversy about the efficacy of free versus structured play (Brooker, 2011; Stephen, 2010).

Pre-primary Teachers perceptions and understanding of play-based learning in Bangladesh

It is aforementioned that in Bangladesh, a child-centred, play-based approach is adopted for pre-primary education. Chowdhury and Rivalland (2012) found that teachers in the pre-primary classes adopted play-based pedagogy, which they gained through special training. They also found that teachers believe that play promotes academic skills such as literacy and numeracy. They also indicated that teachers feel comfortable using play-based methods rather than rote-learning-based teaching. Furthermore, they found that teachers use locally collected play resources (beads, stones, leaves, bangles, bamboo sticks and old pens) during their lessons.

In contrast, Nath et al. (2014) found that learning and teaching in PPE are mostly didactic and rote learning which is far from quality education (Banu, 2914). Chowdhury and Rivalland (2012) also argued that the teachers' perceptions of play-based learning are different from western practices. Thus, research literature shows that the pedagogical approach in early education is not explicitly defined in Bangladesh. Furthermore, pre-primary teachers' views, beliefs, and understanding of play-based pedagogy are almost unknown. This study explores this.

Methodology

In this study, within a case study approach, mixed methods were employed to collect data. The research was conducted in a Sadar Upazila in the South-west part of Bangladesh. The pre-primary teachers of the government primary school GPS) in that Upazila were considered as the population in this study. Participants of this study were the fifteen days trained pre-primary teachers of the selected primary schools.

The purposive sampling technique was utilized in the data collection process for the survey, teachers' interviews and observations. For the selection of the sample, some specific criteria were followed. The first sampling criterion was that the participant should have fifteen days of pre-primary education training; based on this criterion, fifty-five pre-primary teachers of those schools were selected as participants for the survey. Three participants were interviewed from three schools that were surveyed. For classroom observations, two schools were selected purposefully from those surveyed: one from the urban area and the other from the rural area.

The study was conducted after the proper approval of ethical guidelines from the concerned authority. For teachers' interviews, consent forms were sent to the participants before conducting interviews. The participants were also ensured that the confidentiality and anonymity of the respondents were maintained throughout the study. During interviews, the participant's name was substituted with Teacher 1, Teacher2 & Teacher3 and recorded on the transcript as a single initial. Children's wellbeing is at the heart of the study, and it will be maintained throughout the research.

Questionnaires

Questionnaires were used to collect data from the selected samples. The questionnaires were developed based on the research questions, which addressed learning and teaching approaches, professional knowledge and attitudes, and play-based pedagogical knowledge of the teachers. The questionnaires were validated by the expert of the University of South Wales. Fifty-five questionnaires were sent to the participant through the Upazila Education Office (UEO) of that Upazila. Participants were asked to return the questionnaires within a set time (fifteen days) to the researcher. A consent letter was attached to the questionnaires, and the participants were ensured that they could withdraw from the study by not completing the survey or returning a blank survey. After returning the questionnaires, they were coded and analysed.

Interviews

A semi-structured interview technique was employed in this study. Three pre-primary teachers of three different schools were interviewed. One-on-one face-to-face interview technique was adopted in the interviews. All the interviews were conducted by the researcher himself. During interviews, previously developed interview protocols were utilised. However, during the interview, it was modified according to the conversations. This is one of the benefits of adopting a semi-structured interview approach. The duration of the interviews was between 20-30 minutes. The interviews were conducted in the local Bengali language and later transcribed into English. The purpose of interviewing the pre-primary teachers was to examine their soundness of pedagogical knowledge, beliefs, and views about play-based pedagogy and learning. Interviews were recorded by using an audio recorder, and prior to recording, permission was gained from the respondents.

Observation

In this study non-participant, structured observation technique was employed during classroom observations. A checklist was developed for observing the classroom activities prior to the observations. Two pre-primary classrooms were observed: one from the urban area and one from the rural area. Proper approval and consent were gained prior to the observation from the head teacher and the pre-primary teachers. The observation was held on a single day in each school. The duration of every observation was approximately two hours. During observation, a checklist was used and notes were taken when necessary. For example, notes were taken on classroom settings and facilities, interactions between teacher and children, teaching-learning activities in the classrooms, routines, and other sites related to the research context.

Data Analysis

Questionnaires, interviews and observations data were analysed separately. After data collection was completed raw data from the field were organised soon after coming from the area. Then the data were separately stored in different folders in the researcher's computer. During data analysis the following processes were maintained: data sorting, storing in the computer, transcribing, coding, categorising, patterns emerging to establish themes and interpretation of the findings. Before that, interview data were transcribed verbatim.

The analysis of the data began with coding. By this process, concepts were identified and established by asking questions about the data and labeling. Thus, the interview transcripts were segmented and labeled, which generated several codes. Then similar codes were grouped or categorised to build up themes. Hence coding enabled the researcher to identify similar information (Cohen et al., 2011), and group similar incidents and events into categories that generated topical themes. During the data analysis process, anonymity and confidentiality of the respondents were strictly maintained using initials instead of the participants' names. Finally, the findings of the study were presented descriptively under each theme based on the research questions.

Findings and discussion

In this section, I present findings based on analysis of both quantitative and qualitative data. Major findings have been presented here and discussed in the light of scholarly literature and from the perspectives of researchers. The interpretation of the interviews, observations and survey data revealed the respondents' perception and beliefs of play-based pedagogy as follows:

Pre-primary teachers' lack of understanding of play-based pedagogy

Findings from the quantitative data analysis indicated that 20% of teachers strongly agreed, 56% agreed, 22% disagreed, and 2% strongly disagreed about having sound knowledge and understanding of play-based pedagogy. It is clearly shown that a significant number of teachers differed that they had helpful knowledge.

Findings from the analysis of qualitative data (interviews and observations) indicated that though the teachers had some understanding of play-based pedagogy, teachers having a lack of understanding as well as misconceptions of play-based pedagogy were evident. Some data extracts from teachers' interviews are provided here as examples of teachers' perceptions:

Teacher 1:

> For example, playing with colours; if I want to teach them the name of some colours, I can do it with children rather than do it by myself. I can call two children and ask one to find out the red colour (from different colours). When they are doing so, other children are watching. If he or she can do it correctly, they clap for them. If they make a mistake, children say no madam, no madam in this way.

Teacher 2:

> If I teach children through play rather than direct teaching, they become more eager to learn. They become more attentive to the lesson. As a result, they do not feel bored at lessons rest of the time, rather they get interested. They cannot understand that they are learning. They think they are playing.

Teacher 3:

> If we teach using only books, children may not want to learn. So, I teach them through play. .... For example, if I want to teach them counting, I say, let us play with pebbles. I lay some pebbles on the floor. Then I call a boy or girl to see how many are there. He or she counts. If they count correctly, other children clap for them. If it fails, I might ask for help from another in this way. It is similar to playing. If I do like this, it is good.

The observation also found that teachers adopted a play-based way to deliver their lessons in the classrooms. In addition, guided and free play activities are incorporated into the class routine. However, this pedagogical approach is different from the Western understanding of play-based pedagogy (Chowdhury and Rivalland, 2012). It was found that activities were teacher-driven and teacher-directed rather than child-initiated, which supports the claim made by UNESCO and UNICEF (2012) that the teaching approach in the pre-primary classes is still largely didactic and academic than play-based, exploratory and joyful.

Truly understanding pedagogy is important for their practice (Stephen, 2010). Banu (2014) states that teachers' beliefs and values about curriculum content and pedagogy impact their classroom practices in schools. Although the findings indicated that most of the teachers (76%) claimed that they had enough knowledge of play-based pedagogy, findings from qualitative data indicated that teachers' perception was partially aligned with the concept of play-based pedagogy explored in the scholarly literature.

Importance of play and play-based pedagogy

Quantitative findings also indicated that all fifty-five pre-primary teachers agreed (80% strongly agreed and 20% agreed) that learning through play is essential in pre-primary class.

Similarly, from in-depth interviews, all the interviewees admitted that play is essential for children, and they stated the following ways:

Teacher 1:*Of course.*

Teacher 2:*Yes, important. Play is essential for everybody, and for children, it is most important*

Teacher 3:*Of course, important.*

Most of the respondents acknowledged that play-based learning is important for children. In response to the question 'Do you think play is important for children?' most of the pre-primary teachers indicated that play is important for children's physical and mental

development. They also mentioned play has several benefits: increase attendance rate, develop socialisation, and introduce environmental awareness.

Similarly, during in-depth interviews, the respondents stated:

Teacher 1

I think child development means physical, mental, spiritual and ethical development, which begins in childhood ... through play, there is a chance to take a turn that helps children be patient.

Teacher 2

Because play helps children's physical and mental development. Play is beneficial both for the body and mind. Especially, children like play.

Teacher 3

... play helps children's physical and mental development. Play helps children to be united and social.

The findings demonstrated that all the respondents supported that play is important for children development and learning and emphasised play in the following areas: physical and mental development, social development, attendance, depth of earning, relationship with parents, reduction in fear of school, interaction, child-cent redness and awareness of the environment. Chowdhury and Rivalland (2012) claimed that the play could help young children overcome their fear about school and accelerate children's learning. Profeta (2012, p.30) found, "Play is foreseen as promoting children's learning and development, as well as the idea of children as active learners in the Early Learning Development Standard (ELDS) of Bangladesh."

Although all the respondents acknowledge the importance of play-based pedagogy for the learning and development of children, a quarter of them disagreed with having good knowledge of the pre-primary curriculum. It indicates that these teachers were promoting play-based pedagogy in the pre-primary classes without understanding the pre-primary curriculum, which is the main document of play-based pedagogy for pre-primary education in Bangladesh.

Teachers' professional development and training

Both quantitative and qualitative data indicated that training was very important for implementing a play-based pedagogy in the pre-primary classes.

Findings from the quantitative data indicated that 7% of teachers strongly agreed, 56% agreed, 16% disagreed, and 21% strongly disagreed that pre-primary training has fully prepared them to conduct the pre-primary classes. Another important finding was that all the teachers agreed (78% strongly agreed and 22% agreed) that they needed more training to implement play-based pedagogy in the pre-primary classes.

During interviews, respondents also claimed that they need more training because they believed fifteen days of pre-primary training was not enough for them. They commented in the following ways:

Teacher 1

> I think fifteen days of training is not enough for conducting the pre-primary class. Moreover, to know the child and nature of children learning, long-term training is needed.

Teacher 2

> There are lots of things in that training, and I tried to receive all those things attentively. However, it is not possible to remember all the things. Always there is a gap. So, I think there should be a chance to share ideas with other participants after an interval, at least six months. Then we can organise things properly.

Teacher3

> A teacher cannot be an expert in all areas. There are lots of works in pre-primary class: songs, arts and crafts, and many more. To teach those areas, I need additional preparation. If I hadthe opportunity to take training on those subjects separately, I think I could teach children properly. Children will get more interested.

Findings demonstrated that although a majority of the teachers claimed that training had prepared them well. This finding has important implications for revisiting the pre-primary training modules. In fact, fifteen days of training was seemed insufficient for them. Also, in the current training package, there is no refresher training. Training has been emphasised in the pre-primary expansion plan guidelines. It is proposed that all teachers have the proper training to conduct learning and teaching effectively in the pre-primary class (DPE, 2012). *The Operational Framework for Pre-primary Education* also mentions training for teachers/facilitators and capacity building for organisation and personnel (MoPME, 2008).

Conclusion

In summary, the study concludes that the play-based pedagogy curriculum set out in the policy document needs to be implemented more rigorously. The pedagogy in Pre-primary Education is neither play-based nor fully rote-learning. However, the pre-primary teacher upholds positive attitudes to play-based pedagogy and strongly value play in PPE. Children also prefer play or play-based activities in schools. The study also revealed that there is a lack of sufficient knowledge of play-based pedagogy among the pre-primary teachers, which should be overcome. Because their perceptions, views and understanding of play pedagogy affect their practices. Proper training and orientation could be effective in promoting knowledge among the practitioners. Nevertheless, the study suggests and upholds a play-based pedagogy to achieve the goals of Pre-primary Education as well as a smooth transition from pre-primary to primary classes.

Further research can be conducted more broadly to explore the play-based pedagogy in pre-primary education in Bangladesh, where other stakeholders can be involved, and different perspectives can be investigated and analysed. The scope should be expanded to look into the challenges of implementing play-based pedagogy in Bangladesh.

Though the findings of this case study research are not generalizable, the insights from the findings have implications for policymakers, teachers and teacher educators towards the effective implementation of play-based pedagogy and quality pre-primary education in Bangladesh and beyond.

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Play-Based Approach for Developing Number Concepts at Pre-Primary Level in Bangladesh: Practices, Challenges, and Ways to Overcome

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Abstract

The play-based approach has been recognized as a developmentally appropriate method for teaching-learning mathematics, especially for young children. The study explores the practices for number concepts development in the pre-primary level education of Bangladesh and the teachers' challenges during the play-based approach. Besides, another purpose of the study is to identify the tentative ways to overcome those challenges. It is a qualitative case study, and eight teachers participate from eight government primary schools. Data have been collected by using an in-depth interview schedule and a semi-structured classroom observation method. The results show that teachers mainly used a traditional direct instruction approach rather than a play-based approach in the classroom during pre-primary mathematics teaching. Inadequate budget for buying play materials, workload, large class size, and managing special needs students have been identified as the challenges of implementing a play-based approach. A well-decorated classroom with full of play materials, support from an assistant teacher to managing a large number of students, and training to manage special needs students have been explored as the tentative solutions to overcome those challenges. In addition, a favorable classroom environment and parents' support are essential to implementing an effective play-based approach in the situation of Bangladesh.

Keywords: Play-based Approach, Developing Number Concepts, Pre-Primary Education, Classroom Practice, Challenge.

Introduction

Pre-Primary Education (referred to as PPE hereinafter) is emphasized globally through the Sustainable Development Goals (referred to as SDGs hereinafter)- 4.2 due to its' importance for children's lifelong learning and overall development. The Government of the People's Republic of Bangladesh has emphasized the idea of implementing a one-year PPE as a part of achieving SDGs and ensuring quality primary education throughout the country (DPE, MoPME, 2018 & 2019). As part of ensuring the quality of this stage, a pre-primary curriculum was developed for five-year-old children, which is one of Bangladesh's critical educational accomplishments in the system of education (DPE, 2012).

Number concepts are necessary mathematics skills, and preschool students should be competent in those skills to achieve other mathematical skills. Elementary mathematics is one of the learning areas of Bangladesh's pre-primary curriculum and the area includes number concepts (NCTB, 2011). The proficiency of number concepts at the preschool stage plays a vital role in the improvement of mathematics achievement in the next grades of formal schooling (Aunio & Niemivirta, 2010; Chin & Zakaria, 2015; Clements & Sarama, 2013; Desoete & Grégoire; 2006; Duncan et al., 2007; Geary, 2015; Kelanang & Zakaria, 2012; Manolitsis, Georgiou, & Tziraki, 2013; Reid & Andrews, 2015; Stipek, Schoenfeld, & Gomby, 2012; Tremblay, Boivin, Peters, & Bisanz, 2011). Contrariwise, poor performance on mathematical knowledge at the pre-primary level affects students' poor performance in the next grades (Desoete & Grégoire, 2006; Duncan et al., 2007).

In the early years of education, play is vital for young children's overall development (Onditi, Otengah, & Odongo, 2018). Besides this, Stipek, Schoenfeld, and Gomby (2012) stated that meaningful math activities could nurture students' development through play and daily actions. Preschool students can effectively learn the number concepts through a play-based approach because it is recognized as one of the important methods by the researchers for pre-primary students' overall development.

Therefore, Bangladesh's pre-primary curriculum suggested "Play" as one of the most effective techniques for implementing the pre-primary level teaching-learning activities, especially to develop the young children's number concepts (NCTB, 2011). This study focuses on the development of number concepts through a play-based approach. It emphasizes classroom practices, challenges, and ways to overcome those challenges in real classroom settings during pre-primary mathematics lessons in Bangladesh.

Problem Statement

The current pre-primary curriculum-2011 provided the guidelines for mathematics teaching and suggested the child activities through play in a group and individually by utilizing different real objects, number cards, and charts. Besides, it included a stepping game and a matching game (NCTB, 2011). However, CAMPE (2013) found that the teachers mainly emphasize reading and memorizing the numbers collectively or individually using the textbook, blackboard, and number charts. Therefore, it shows the inconsistency between the plan and practice of pre-primary mathematics teaching.

Purpose of the Study and Research Questions

The study's purposes have been divided into three parts- first; it explores the current practices of teaching-learning activities for number concepts development. Secondly, it investigates the challenges faced by the teachers during the implementation of a play-based approach at the pre-primary classroom for number concepts development. Finally, it

determines the tentative ways to overcome those challenges in the context of Bangladesh. To fulfill the purpose of the study, the following research questions have been identified:

1. How do the teachers practice teaching-learning activities for number concept development in the pre-primary classroom?
2. What are the teachers' challenges to implementing a play-based learning approach for number concepts development in the pre-primary classroom?
3. What are the possible solutions to overcome the challenges for implementing a play-based learning approach for number concepts development in the pre-primary classroom?

Literature Review

Number concepts refer to the conceptual understanding of number representations. Number concepts are necessary mathematics skills, and pre-primary students should be competent in those skills to achieve advanced mathematics learning (Chin & Zakaria, 2015; National Center on Intensive Intervention, USA, 2015; Rips, Bloomfield, & Asmuth, 2008). Number concepts consist of several concepts related to numbers. Clements and Sarama (2009) stated ten (10) essential number concepts for pre-primary level students (5-6 years). Those are Subitizing (the ability to recognize the quantity by observing the set of objects), verbal counting, object counting, writing numbers, the concept of zero, number comparison, number ordering or ordinal numbers, number estimation, counting on, and counting back.

The teaching-learning process is significant for developing number concepts, and the process involves both teacher and students. Based on teacher and students' roles, there are different categories for preschool-level mathematics teaching. The process incorporates teachers' and learners' interaction in the classroom and teachers' utilization of teaching materials (UNESCO, 2004). Baroody, Clements, and Sarama (2019) argued two instructional approaches for preschool-level mathematics teaching. (a) "Direct Instruction Approach"- the teacher thoroughly explains the procedure to solve the mathematical problem and then offers practice opportunities, provides feedback, and reduces the chances of students' explanations. (b) "Partially Guided Approach"- the teachers provide direction and scaffolding for involvement with the teacher-decided task, and the direction should be implicit with minimal guidance.

Direct instruction is developmentally inappropriate for preschool students whether a play-based approach is regarded as a child-friendly, developmentally appropriate teaching-learning approach. Fesseha and Pyle (2016) described that the play-based approach uses play and playful methods for teaching-learning practices that are developmentally appropriate and child-centered, where teachers guide students through their experiences. Stipek, Schoenfeld, and Gomby (2012) found that the USA faces more obstacles in its past due to applying developmentally inappropriate methods that are more academically focused instruction and less time in play for the early years of mathematics preschool to teach isolated skills. A play-based approach is required to overcome those obstacles.

Students can learn number concepts better through a play-based approach. Oğul and Arnas (2016) found that in times of outdoor play, students frequently learn rational counting, comparing and ordering objects, spatial sense, operation (i.e., addition, subtraction, and division), and measurement (i.e., volume, length, and weight) skills, writing numerals, and problem-solving skills.

However, different types of challenges faced by the teachers are liable to implement teachers-centered direct instructions instead of a play-based approach. Puteh and Ali (2013) found that different challenges such as class time, classroom space, teachers' lack of knowledge, and skills enforce teachers to implement teacher-oriented activities in the pre-primary classrooms.

Methodology

A qualitative case study research method was followed throughout the study for confirming the in-depth understanding of the research. Sample teachers (N=8) were selected from eight government primary schools by following a criterion sampling technique. The criteria for selecting the sample were directly recruited teachers for the pre-primary class, the teachers who received 15 days of induction training and completed a 1.5 years Diploma in Primary Education (DPEd) course. Data were collected from the pre-primary teachers through in-depth interviews and observation of mathematics classroom activities through a semi-structured classroom observation schedule.

The classroom activities for mathematics teaching (number concepts such as subitizing, matching objects with numbers, verbal and object counting, etc.) were observed for 20-30 minutes in five (5) consecutive days. The last day of the school visit included an in-depth interview of teachers. To gather data through the classroom observation schedule, the researchers took detailed notes of teaching-learning activities and shoot video recordings with the prior permission of the teachers. For teachers' in-depth interviews, the researchers took detailed notes based on their answers and then read the answer sheet to determine the dissimilarities. Besides this, the audio of the entire classroom activities was recorded with prior permission from teachers.

Data were analyzed through thematic analysis by using coding and categorizing. Descriptive and In-vivo coding methods were applied for data analysis. The entire data set was coded manually. For thematic analysis, the data were transcribed, coded, and categorized to explore the theme. Data from video and audio recordings were utilized to crosscheck the written information to ensure the data's appropriateness. To ensure the validity of the data, instrument triangulation (Cohen, Manion, & Morrison, 2018; Yeasmin & Rahman, 2012; Zohrabi, 2013) method was followed by applying different data collection instruments (such as in-depth interview schedule for teachers and observation schedule for the classroom) for the study. To ensure confidentiality, the researchers used different code names for teachers (such as T1, T2, T3, T4, T5, T6, T7, & T8).

Results

Major themes and sub-themes were emerged from collected data and literature review to answer the research questions. The different portions of the discussion will be based on those themes and sub-themes.

Classroom practices for number concepts development-

This part mainly included the teachers' instructional tasks and students' actions for different number concepts learning-

- ***Classroom practices for Subitizing***

Teachers show real objects (such as skewer, number of students, marble) and tell students to count one by one. They also draw pictures on the board and tell students to

count. Students count objects based on teachers' instructions and answer the questions. It shows that teachers encourage students to count the objects, not the perceptual understanding but based on the observation, which is considered as a pre-requisite for Subitizing.

- ***Classroom practices for matching objects with numbers***

At first, teachers use real objects (e.g., skewer, number of students, marble, classroom' objects such as doors, window), and then teachers show semi-real objects such as pictures in the textbook or draw them on the board. One of the teachers (T2) also draws pictures on poster paper and uses them as teaching materials. Teachers tell students to count the objects one by one. They also instruct students to write the numbers in the activity sheet or notebook based on counted objects. Teachers also call some students in front of the class to write numbers on board after their writing. Students follow teachers' instructions and answer teachers' questions. It shows that teachers apply a direct instruction approach by using different objects for counting and writing those numbers.

- ***Classroom practices for verbal and object counting***

To practice verbal and object counting, all the teachers provided real objects (e.g., wooden skewers, tamarind seeds, and buttons, marble, skewer, fingers, and other things inside the classroom such as bench, fan, door, window) and semi-real objects (i.e., pictures which was drawn on the board/ poster or the textbook) for the students. Usually, at the beginning of the teaching, students counted with teachers, and within time being, if they can memorize the name of the numbers, they count by themselves. In that time, teachers observe their activities and provide necessary feedback if necessary. However, it was found from classroom observation that teachers could not observe all students' activities in times of their practices due to a large number of students. Most of the teachers (T2, T3, T4, T6, T8) told students to count the objects one by one. One of them (T 4) states that

"Sometimes they count with me or by themselves. If the number of objects is more than 10, it becomes tough for the students. In that case, at first, I say the name of the numbers (11-20). After that, I tell them to count objects."

One of the teachers (T 1) showed students how to count objects through a one-to-one approach by using real objects. Then she tells students to draw many pictures and color the pictures and count by themselves. Students try to count, and teachers help them to count properly. The teacher (T1) states that

"I tell them to count with me, and draw the pictures from the textbook. When they draw pictures and count, I check their activity. If they fail to count, I tell them to draw, and then I also draw pictures on board and show them how to count."

The data shows that the teachers provide students the guideline to apply counting principles properly and then tell them to count by using pictures that encourage them to memorize the numbers.

- ***Classroom practices for writing numbers***

Teachers usually suggest students count pictures from the textbook, and based on cardinality, teachers show them how to write the numbers by using a blackboard. Then teachers instruct students to write numbers in their notebook by following the board's instructions. They also suggest students check their textbooks and write based on the drawing pattern included in their textbooks. Teachers tell them to practice writing following the activity sheet from the textbook. In the activity sheet, there are some sets of objects and a blank box beside them. Teachers instruct them to count objects and write numbers in the blank box based on cardinality. Students follow teachers' instructions and

practice writing. Teachers usually observe their activities to check their writing and provide feedback if necessary. One of the teachers (T1) states that-

> *"In times of their writing, I check their activity sheet and notebook. If they write in the wrong manner, I write the numbers in their notebook in the right way and tell them to follow."*

Sometimes teachers emphasize writing in a sequence and memorizing the numbers in a sequence. Another teacher states (T8) that

> *"Sometimes I write the numbers serially on the board and then tell students to write serially."*

The data shows that teachers encourage students to follow their instructions to count the objects and write the numbers and students follow teachers' instructions.

- ***Classroom practices for the Concept of Zero***

To teach the concept of Zero, teachers use the idea of subtraction and 'nothing.' Most of the teachers (75%) keep some objects in a box and then reduce the number of items. Finally, show the blank box to explain that it will be Zero if there is nothing. In addition, they draw some boxes on the board and draw some objects inside those boxes, such as four apples, three apples, two apples, one apple, and no apple. Then provide the idea that nothing can be presented as "0" in mathematics. The teacher also suggests students complete the activity sheet from the textbook. Students answer based on teachers' questions and follow their instructions. One of the teachers (T3) states that

> *"I use real objects like pencil, skewer, pen, and also draw pictures and show them at first four objects, then I reduce one object and ask how many objects are there? Again, I reduce another object and ask how many? In this way, I draw a box without any object, and I ask them- what will be the number? I show them the textbook. Then show the pictures from the textbook and tell them to practice in the textbook. Students answer my questions and also do the task in the activity sheet of the textbook."*

It presents that teachers try to teach through subtraction concepts and suggest them to memorize that if there is nothing then it will be zero. Also, use an activity sheet for writing practice.

- ***Classroom practices for number comparison and ordering***

For students' learning of number comparison and number order, teachers display two or three groups of students, provide two or three sets of objects, show two sets of fingers from two hands, pictures from a textbook, or draw two sets of objects on board. After that, they say students to count objects and write numbers. Then they ask students to identify which group has more/less or to identify large/small numbers and to organize numbers (small to large /large to small). Also, they write 2 or 3 different numbers on the board. They ask students to identify large/ small numbers and to organize numbers based on the sequence (small to large /large to small). One of them (T1) states that

> *"I call students in front of the class and make two or more groups. Then tell others to count and compare the groups based on the number of students. I take a number of the skewer in my two hands and tell students to count and compare. I also write numbers on the board and tell them to find out the small or large ones. Besides for number order, I tell them to write serially like small to large or large to small."*

The data represent that teachers suggest students for counting real and semi-real objects and writing numbers based on the counted objects to teach the number comparison and ordering. Students just follow teachers' instructions.

- ***Classroom practices for identifying the missing numbers***

It was found from the teachers' interviews that half of the teachers (T2, T3, T7, T8) did not practice it. However, they think that as the students know the numbers (0-20) serially, they can do it easily. One of them (T8) states that

"I did not teach it. As the students know from 0-20, so if I ask any missing number, they can answer."

The remaining of them (T1, T4, T5, T6) attach the number cards or write numbers in a sequence on the board and omit a few numbers. Then ask students to find out the missing numbers or write the missing numbers on board or in their notebook. Students perform based on recalling the sequence. One of them (T1) states that

"I attach the number cards serially on board and remove some of the number cards from the line. Then ask them to find out the missing numbers."

It shows that teachers mainly encourage counting or memorizing numbers in a sequence to identify the missing numbers.

- ***Classroom practices for counting on and counting back***

Most teachers (75%) write the numbers on board in a sequence or reverse and ask students to say the numbers' names (T2, T3, T4, T5, T7, T8). The remaining of them (T1, T6) use a number chart and instruct students to say the numbers' names. Students follow teachers' instructions and they can easily say the name of numbers in counting on but face problems in counting back. One of the teachers (T4) asserts that

"Students made mistakes in counting back as it is not serially, so they face problem to recognize the numbers."

Teachers mainly encourage students to memorize the numbers in a sequence or reverse by counting on and counting back. Students feel easy to memorize in a sequence rather than in reverse.

The above data presentation regarding the instructional tasks shows that the teachers mainly follow three types of activities emphasizing teaching materials as described below (1.1).

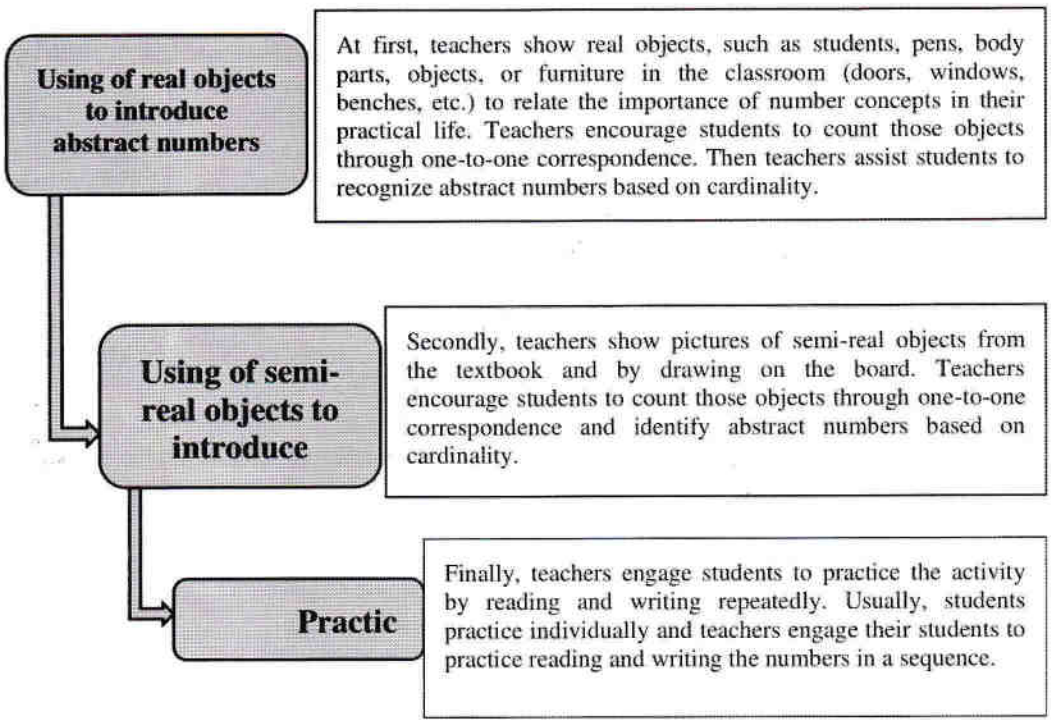

Figure 1.1: Flow chart of teachers' followed three types of activities

Challenges faced by the teachers to implement a play-based approach for number concepts development at pre-primary classrooms-

Teachers face different obstacles to implementing a play-based approach for teaching-learning practices of number concepts development in pre-primary classrooms. Those are discussed below:

- ***Lack of conducive classroom environment***

Teachers face challenges in engaging students in mathematics class activities and keeping their concentration for a long time due to the lack of a conducive environment. For instance, there are no number-oriented play materials such as blocks, puzzles, dice or spinner-related toys inside the classroom. One of the teachers (T4) states that

> *"If there are more students, then it is tough to manage them; they make too much noise, which is disturbing for the class. To engage them in mathematics activities and also for proper teaching, a decorated room is required with an adequate number of related teaching materials and toys."*

- ***Lack of budget to arrange play materials for the classroom***

Most teachers (75%) indicated that the budget is inadequate to buy number-related teaching and play materials for pre-primary students (T1, T2, T3, T5, T6, T7). One of the teachers (T2) states that

"Every year, we received only five thousand (5000) taka from the Thana education office to buy materials for the pre-primary classroom. This amount of money is not adequate to arrange different types of number-related play materials."

The data showed that the school received a few amounts of money from the Upazila Education Office (UEO), so, they could not arrange an adequate amount of number-related play materials such as blocks, puzzles, etc. As a result, they are unable to arrange a conducive classroom environment to ensure play-based teaching-learning for number concepts.

- ***Workload and a large number of students***

Most teachers (75%) stated that they face pressure to manage students due to many students (T2, T3, T4, T6, T7, T8). Also, they need to carry on other classes' responsibilities such as grades 4, 5. As a result, they could not conduct the teaching-learning properly. One of them (T3) states that

"It is tough to properly manage the pre-primary classroom and conduct teaching-learning because of the workload of other classes and many students."

Teachers are required to think deeply to take preparation and standard class size to manage students to conduct play-based teaching-learning for number concepts development. However, due to the workload of other classes and a large number of students at the pre-primary class they could not manage a play-based teaching-learning approach.

- ***Lack of time for proper preparation of the classroom activities***

Half of the teachers (50%) face challenges in managing time for proper planning and preparation to ensure a play-based approach for pre-primary classes' number concepts teaching-learning activities (T2, T4, T5, T6). One of them (T6) states that

"I think it is required adequate time for proper preparation to conduct teaching-learning through play-based approach for pre-primary level. However, after finishing the pre-primary class sessions, I need to conduct 6-8 sessions in other classes every day. Then I became so tired and could not manage time to plan and prepare to ensure play-based approach for pre-primary students' number concepts development."

Due to the lack of time, most of the teachers could not take proper preparation to confirm play-based teaching-learning activities for number concepts development at the pre-primary level.

- ***Manage special needs students due to lack of training***

One of the teachers faces problems managing autistic students, as she does not have any training to manage autistic students with normal students. She states (T1) that,

"It is hard to conduct teaching for special needs students, especially autistic along with normal students as I do not have any training on that. Special needs students make a disturbance in the classroom."

Data show that the teacher faces challenges in managing autistic children and normal students to ensure a play-based teaching-learning approach, which requires active participation.

Ways to overcome those challenges-

Teachers provided suggestions to overcome the challenges of ensuring a play-based approach and improving overall teaching-learning practices for pre-primary students' number concepts development. The suggestions are included here:

- ***The requirement of the decorated room with supporting materials***

Since the students could not concentrate in classroom activities to engage students in class activities, the classroom should be decorated with number-related materials and toys. Thus, they can play with these toys and learn number concepts. One of the teachers (T3) suggests that

> *"For the pre-primary students, the room should be colorful with having playing materials."*

Teachers mainly suggest a separate classroom for pre-primary students with number-oriented play materials that will create opportunities for students to play.

- ***Parents support in organizing the classroom decoration and maintaining the decoration***

Teachers find it difficult to organize and manage the decoration of the classroom due to many students. They recommend for parents' support to organize and manage the decoration of the pre-primary classroom. One of the teachers recommends (T6) that

> *"As we have many other responsibilities, so, parents' involvement will be supportive for us to manage the decorated classroom."*

It demonstrates that the workforce is limited in the school and the teachers are busy with other activities in the school. As a result, they face problems maintaining the classroom decoration. Therefore, they require parents support in organizing the classroom decoration and maintaining the decoration for ensuring play-based approach

- ***Class size should not exceed 30***

As the teachers face challenges in managing the large class size, they suggest that the class size should not exceed 30. One of the teachers (T8) recommends that

> *"To ensure play-based learning approach in the pre-primary classroom, the students' number should not be more than 30 in each class."*

Teachers provide the suggestion for standard class size to manage the play-based approach in the pre-primary classroom for number concepts development.

- ***Support of assistant teacher***

To manage many students in the same classroom and special needs students, some teachers (25%) suggested that it would be better if there were provisions to receive assistance from another teacher. The teacher (T4) recommends that

> *"In the Pre-primary class, there are more than 60 students, and it is tough to manage by one teacher. It would be better if there were another teacher. Some students sleep without reading or writing, and some want to go to the toilet many times within 2.30 hours. If there are two teachers, then it becomes easy to manage them."*

For the proper management of a large number of students for a play-based approach, teachers recommend receiving the support of another teacher. Therefore, the assistant teacher can support the pre-primary teachers in preparing and managing a play-based approach for number concepts development.

- ***Training provision for managing special needs students***

One of the teachers suggests that it would be better to have the proper training to manage special needs students in the same classroom as normal students. It shows that to

ensure all students' active participation, it is mandatory to support special needs students and normal students. This is quite impossible if the teachers are not properly trained, so, the teacher suggests the training provided to manage special needs students.

Major Findings and Discussion

The study revealed that the pre-primary level teachers mainly applied the traditional teacher-dominant direct instruction approach rather than the play-based approach during the conduction of teaching-learning activities in the classroom. This kind of approach guided students to memorize the number names instead of understanding number representations. Similarly, previous studies found that teacher-centered direct instruction is developmentally inappropriate for pre-primary level students due to its' emphasis on students' memorization of mathematics (Baroody, Clements, &Sarama, 2019; Stipek, Schoenfeld & Gomby, 2012).

Besides this, the study explored that teachers prioritized whole-class demonstrations with students' group responses and no time for playing freely due to the teacher-centered direct instruction. Likewise, Aboud and Hossain (2011) found that there was no time for free play in the preschool classroom, mostly class activities, which required group response and few informal talks between students and teachers.

It has been found that the teachers could not implement a play-based approach for pre-primary students' number concepts learning because they have to face many challenges. One of the major challenges is the inadequate budget for buying teaching or play materials. A conducive classroom environment has not been found in most of the schools due to a lack of financial assistance for organizing play materials for the classroom. Pre-primary teachers could not take the preparation properly for pre-primary level mathematics lessons because of the large class size and extra responsibilities. In addition, teachers faced challenges to manage special needs students with normal students in the same classroom, as they are not properly trained. Similarly, Fesseha & Pyle (2016) found that teachers face many challenges, such as managing adequate time to plan play-based activities to complete curriculum content, prepare a conducive environment, and playfully learning opportunities for students.

The study explored teachers who provided feasible solutions to overcome those challenges. They suggested a well-decorated classroom with supporting number-related materials such as blocks, puzzles, dice or spinner-related toys, board/ cared games-related toys, etc. Besides this, to organize and maintain the classrooms' ornamentation, teachers felt the necessity of parents' support. Teachers also recommended that to manage the class properly the class size should not exceed 30. In addition, the class teachers required the support of another assistant teacher to manage a large number of students and special needs students in the same classroom. One of them suggested the training to manage special needs students, especially autistic students, in the classroom.

Implications

Some practical implications for both policymakers and pre-primary teachers have been explored by the current study. The pre-primary teachers described their current classroom practices, which showed their deficiency in implementing a play-based approach and utilizing inappropriate teaching-learning approaches for this level of children. This finding can make other pre-primary teachers sensible about their current practices, and they can be able to improve their teaching-learning practices. Teachers identified some challenges and the way to overcome those challenges, which can suggest policymakers, to eliminate those challenges and support the pre-primary teachers to

implement a play-based learning approach to develop the number concepts of pre-primary students.

Conclusion

This study explored the actual practices of number concepts in pre-primary classes and identified some teachers' challenges in implementing a play-based approach for number concepts teaching-learning. At the same time, it discovered some probable ways to overcome those challenges. Most of the teachers mainly applied the traditional teacher-dominant direct instruction approach, highlighting the whole-class demonstrations with students' group responses. Major challenges were the lack of budget to arrange a number-related materials and toys for the pre-primary classroom, lack of time for the teacher to take proper preparation because of large class size and workload, and lack of training focusing on the management of special needs students. To overcome those challenges, teachers suggested some solutions (such as preparation of a conducive classroom environment, support from parents and other assistant teachers, small class size, training to manage special needs students). As the absence of implementation of the play-based approach may reduce the appropriateness of the number of concepts development of pre-primary students, it is required to provide proper support to the teachers to implement a play-based approach to develop pre-primary students' number concepts appropriately.

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Weakness in Four Mathematical Operations of Grade Three Students: Causes and Remedies

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Abstract

This study aims to analyze the Weakness in Four Mathematical Operations of Grade Three Students: Causes and Remedies. The mixed-method qualitative approach with explanatory sequential design has been applied to conduct this study. From 8 divisions, 8 Upazila were selected randomly. Two from each Upazila, a total of 16 schools were selected where one was located in the urban area and one was in the rural area and this selection was done through random sampling technique. From those selected schools, a total number of 394 class three students were selected where 24-26 students of class 3 were selected randomly from each school. Data were collected from those teachers who had conducted the mathematics class in class three in the academic year, 2019. Four types of collection tools were used to meet the research objectives of this study: An achievement test, classroom observation checklist, the interview schedule was used for Teachers and focus groups discussion guidelines. Quantitative data were analyzed through descriptive statistics and the qualitative data have been analyzed following the thematic approach. Students' performance is not satisfactory (45.7%). The maximum number of teachers face problems in teaching grade 3 mathematics. The researchers outlined that In mathematics lessons, teachers have to follow a student-centered approach; using teaching aids, collaboration in solving problems, discussion, and feedback.

Keywords: Four Operations, Quantitative and thematic analysis, Word problems.

Background of the Study

This study aims to analyze the Weakness in Four Mathematical Operations of Grade Three Students: Causes and Remedies. The mixed-method qualitative approach with explanatory sequential design has been applied to conduct this study. From 8 divisions, 8 Upazila were selected randomly. Two from each Upazila, a total of 16 schools were selected where one was located in the urban area and one was in the rural area and this selection was made through random sampling technique. From those selected schools, 394 class three students were selected, and 24-26 students of class 3 were selected randomly from each school. Data were collected from those teachers who had conducted the mathematics class in class three in the academic year 2019. Four types of collection tools

were used to meet the research objectives of this study: An achievement test, classroom observation checklist, the interview schedule was used for Teachers and focus groups discussion guidelines. Quantitative data were analyzed through descriptive statistics and the qualitative data have been analyzed following the thematic approach. Students' performance is not satisfactory (45.7%). The maximum number of teachers face problems in teaching grade 3 mathematics. The researchers outlined that teachers have to follow a student-centered approach, using teaching aids, collaboration in solving problems, discussion, and feedback.

In Bangladesh, there have not been many kinds of research to assess pupils' competencies in mathematics and teachers' beliefs and knowledge about mathematics teaching except NSA. According to the few survey results, pupils' performance is found unsatisfactory in the competencies related to word problems. Such as more than 80% of the students of both types of schools (GPS & BPS) achieved basic number skills but not more than three-quarters of the students of both types of schools achieved the competency on word problem-solving in mathematics (Nath et al, 2007), especially pupils' are weak in solving problems in real life, in the word problems, in the four fundamental rules and the measurement (Uddin, 2005). In Bangladesh, the National students' Assessment (NSA) was conducted in 2006 for Bangla language and mathematics in grades 3 and 5. According to the national assessment of every respective year, student's performance in every key area of mathematics is not satisfactory at the national level. Besides these NCTB also conducted Curriculum Effectiveness and Situation Analysis Study. According to the findings of the study, students' performance in every key area is also not satisfactory. Therefore, it is important to study and carry out research on the weakness of Grade 3 students of four operations in Mathematics in Bangladesh. With this research background, the following research objectives are taken to conduct this study.

Objectives of the study

The objectives of the study are:

1. To know the status of grade three students' performance of four mathematical operations.
2. To explore the weaknesses of four mathematical operations in achieving mathematics competencies by grade three students.
3. To identify the reasons for weaknesses of grade three students of four mathematical operations.
4. To analyze the teaching-learning strategies applied by primary school teachers of Bangladesh in achieving the competencies of four mathematical operations.

The rationale of the Study

The researchers hope that the present study will provide important suggestions and recommendations to ensure quality primary mathematics education. This research article will give a clear image of the grade 3 students' performance status in four operations of mathematics. Besides this article will give a clear picture of the present situation of the weakness in achieving four mathematical operations-related competencies of grade three students and mathematics teaching-learning in the primary classroom of Bangladesh. The government of Bangladesh has been taken different initiatives for ensuring quality

mathematics education. Such as government providing teachers' editions, subject-based mathematics training, ICT training, and academic supervision training, etc.

This research will help the researchers as well as the policymakers to know the status of grade 3 students' performance in mathematics and the implementation status of mathematics teaching-learning in the classroom. This research will help the policymakers to decide the ways of ensuring quality mathematics teaching-learning in the classroom of Bangladesh. Related teachers' educators gain new insights into their role in providing the necessary support to ensure quality mathematics teaching-learning in the classroom. So, this research is very important to ensure quality mathematics education in Bangladesh.

Limitation of the Study

In this research, several limitations arose in this study. The time frame for collecting data from the survey was a significant limitation for this study. Within a short time, survey data were collected. Data was collected from around 480 students through the test. Data were also collected 16 Head Teachers, 16 Assistant Teachers, and only 16 lessons were observed. So small sample size was one of the limitations of this research. There are different types of primary schools. All types of primary schools, there are about 76000 primary schools around the country. However, data were collected only from sixteen government primary schools. Thus the result of the research presents only the situation of the government primary schools. All other schools were excluded from the study.

Methodology

This study followed the mixed-method qualitative approach with Explanatory Sequential Design. At first individual achievement test was used to identify the students' learning level on some predetermined competencies of mathematical skills for class 3 students in phase-1. In the follow-up stage, students' level of learning and areas of gaps were ascertained from the quantitative analysis. These analysis results helped to determine the activities of phase-2. Considering the findings from quantitative analysis, respondents were selected and tools were prepared for the next phase.

Data were collected from those teachers who had conducted the mathematics class in class three in the academic year 2019. To accomplish the study, teaching-learning activities of mathematics classrooms were observed to gather data. Finally, mathematics classroom students of grade 3 were the population for this study, too. The study covered all eight divisions considering the geographical locations in Bangladesh. In both phases (1stand 2nd), the Multistage Cluster Sampling strategies were done to select the sample. The sample categories are as follows:

In the 1st phase, to select the sample students, a multistage cluster sampling procedure was followed. A total of 8 districts were selected, one from each division considering various geographical locations. From each selected district, one Upazila was selected from the Upazila list randomly. A total of 16 schools were selected, two from each Upazila where one was located in the urban area and one was in the rural area and these selections were made through random sampling technique. From those selected schools, 394 class three students were selected, and 24-26 students of class 3 were selected randomly from each school.

Four types of collection tools were used to meet the research objectives of this study. An achievement test was developed for class 3 students to get a clear idea about students' learning achievement in three mathematics teaching areas. A classroom observation checklist was also used for supporting data to meet the research objectives. An interview schedule was used for Teachers. Besides these focus groups, discussion guidelines were administered to get the causes of learning gaps of the student-respondents. The study team first prepared a draft tool for conducting achievement tests of the student for piloting. A team went to five government primary schools at Trishal Upazila in Mymensingh to test the above-mentioned tool's reliability, validity, and objectivity. The team also estimated the total time for answering the piloted questions.

Quantitative data were analyzed through descriptive statistics. The descriptive data were analyzed in a qualitative approach focusing on the objectives of the study and the emerged themes and concepts from the field data. The raw data collected were processed under the proper supervision of the study team and analyzed by applying computer software like SPSS. Descriptive statistics like mean, percentage, and inferential statistics like correlations, t-test, etc., were applied were found appropriate. To conduct this study, the researchers followed the required ethical issues.

Data Analysis and Presentation

The data analysis and presentation contain information about respondents, grade 3 students' performance in four mathematical operations, and respondents' information. Different types of tables and diagrams were used to make the data clear to the readers of the study. In addition, the researchers triangulated data through teachers' interviews, classroom observation, and students' focus group discussions. The data under different captions are presented below according to the sequence.

(I) Students' Achievement Test

i. Overall Achievement of the students

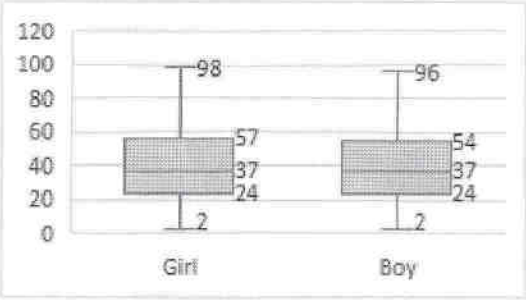
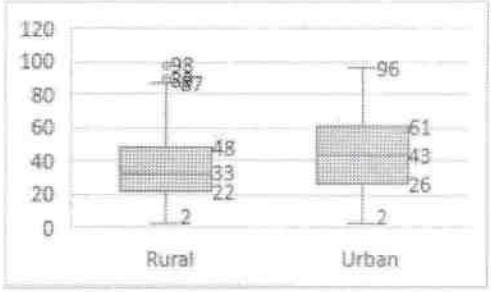


Figure 1 shows the overall performance in percentages of the students by gender. The boxplot illustrates that the performance of both boys and girls is almost similar. Both girls' and boys' median value of their achievement score was 37. Girls got the highest score of 98%, whereas boys got 96%.

Figure 1: Gender wise overall achievement

Location-wise students' overall achievement shows that the median value for rural students was 33 whereas the median value for urban students was 43. Urban students performed comparatively



better than rural students regarding median and 75th quartile values. On the other hand, it also observed that the performance of urban students varies more than rural students.

Figure 2: Location wise overall achievement

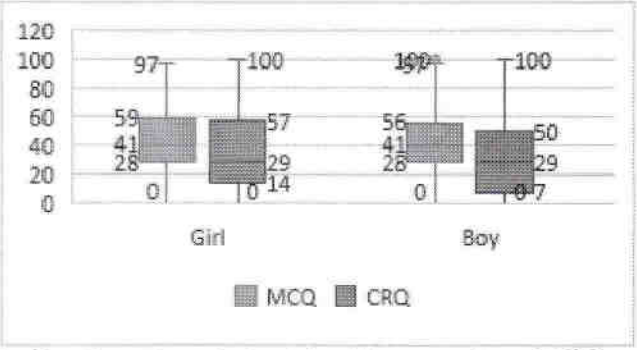


Figure 3: Gender wise students' achievement on MCQ and CRQ

Gender-wise students' achievements on Multiple Choice Question (MCQ) and Constructed Response Question (CRQ) were presented in the above boxplot. For both girls and boys, they performed comparatively better in MCQ than CRQ. In both MCQ and CRQ, the median value is the same for both genders. Thus, the boxplot reveals that girls and boys performed almost similarly in both MCQ and CRQ.

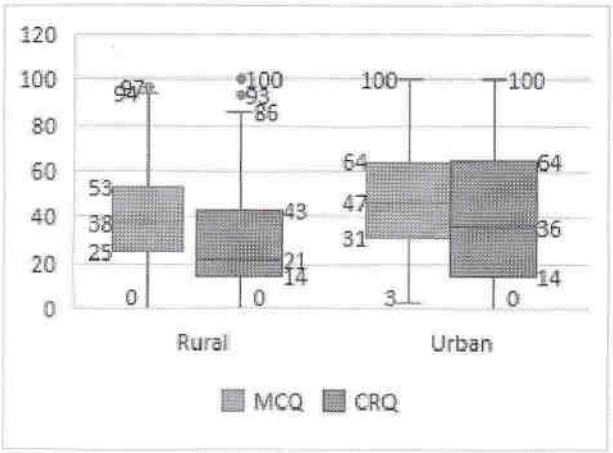


Figure 4: Location wise students' achievement on MCQ and CRQ

Location-wise students' performances in MCQ and CRQ were also identified in Figure 4 and it revealed that urban students performed comparatively better than rural students. The median of urban students was 47 whereas the median of rural students was 38 in MCQ. Again in CRQ, urban students (median 36) performed comparatively better than rural students (median 21).

Table 1: Student's Achievement on Concept of Addition (2 numbers up to 3 digits)

		Correct	Incorrect	Not respond	Total
School Type	Rural	55.7%	25.7%	18.6%	100.0%
	Urban	75.6%	20.7%	3.8%	100.0%
Total		65.7%	23.2%	11.1%	100.0%

The above table 1 shows that on average, the majority 65.7 percent of students can add a maximum of three numbers of two or three digits correctly, which means that they have the concept of number and calculation, while 23.2 percent of students are not able to add a maximum of three numbers of two or three digits correctly. The table also revealed that 75.6 percent of urban and 55.7 percent of rural students have correctly been able to add a maximum of three numbers of two or three digits correctly, which means urban students performed better than rural students in this competence. It is also evident from the table that a very similar percentage of (25.7% and 20.7%) rural and urban students couldn't answer correctly and on average, 11.1 percent didn't respond.

Table 2: Student's Achievement on Concept of Subtraction of 3 digit number

		Correct	Incorrect	Not respond	Total
School Type	Rural	53.6%	37.7%	8.7%	100.0%
	Urban	74.2%	22.5%	3.3%	100.0%
Total		65.7%	64.0%	30.0%	6.0%

The above table 2 shows that on average the majority 64.0 percent, of students can subtract from some three digits a smaller number of not more than three digits correctly, which means that they have the concept of number and calculation while 30.0 percent of students are not subtracted from some three digits or a smaller number of not more than three digits correctly. The table also revealed that 74.2 percent urban and 53.6 percent rural students have correctly been able to subtract from some three digits a smaller number of not more than three digits correctly, which means urban students performed better than rural students in this competence. It is also evident from the table that 37.7 percent rural and 22.5 percent urban students couldn't answer correctly and on average 6.0 percent didn't respond.

Table 3: Student's Achievement on Concept of multiplication

		Correct	Incorrect	Not respond	Total
School Type	*Rural*	28.0%	63.0%	9.0%	100.0%
	Urban	34.4%	61.3%	4.2%	100.0%
Total		31.2%	62.2%	6.6%	100.0%

Table 3 shows that, on average majority of the students (62.2%) could not correctly identify the multiplicand, multiplier, and product in a sum involving multiplication operation while only 31.2 percent of students can identify correctly the multiplicand,

multiplier, and product in a sum involving multiplication operation. The table also revealed that almost similar percentages (63.0% and 61.3%) of rural and urban students could not correctly identify the multiplicand, multiplier, and product in a sum involving multiplication operation, and on average 6.6 percent didn't respond.

Table 4: Student's Achievement on the Concept of division

		Correct	Incorrect	Not respond	Total
School Type	Rural	41.8%	43.3%	14.9%	100.0%
	Urban	39.6%	52.4%	8.0%	100.0%
Total		40.7%	47.9%	11.4%	100.0%

It is evident from the Table 4 that on average only 40.7 percent of students can identify and tell what are dividend, divisor, quotient and remainder in a division sum correctly, while more than 47.9% of students couldn't identify and tell what are dividend, divisor, quotient and remainder in a division sum correctly. The table also revealed that 41.8 percent rural and 39.6 percent urban students have correctly been able to identify and tell what are dividend, divisor, quotient, and the remainder in a division sum correctly, which means rural students performed better than urban students in this competence. It is also evident from the table that (52.4% and 43.3%) urban and rural students couldn't answer correctly and on average 11.4 percent of students didn't respond.

Table 5: Student's Achievement on subtraction and division related problems

		Correct	Incorrect	Not respond	Total
School Type	Rural	44.7%	40.4%	14.9%	100.0%
	Urban	42.7%	47.4%	9.9%	100.0%
Total		43.7%	43.9%	12.4%	100.0%

It is evident from Table 5 that on average 43.7 percent of students can solve two-step problems related to division and subtraction correctly, while a similar percentage of 43.9% students are not able to solve two-step problems related to division and subtraction correctly. The table also revealed that a very similar percentage of urban and rural students (42.7% and 44.7%) have correctly been able to solve two-step problems related to division and subtraction correctly, which means rural students slightly performed better than urban students in this competence. It is also evident from the table that 47.4 percent urban and 40.4 percent rural students couldn't answer correctly and on average 12.4 percent of students didn't respond.

Table 6: Student's Achievement on subtraction and addition related problems

		Correct	Incorrect	Not respond	Total
School Type	Rural	83.4%	6.6%	7.1%	100.0%
	Urban	89.2%	4.2%	4.7%	100.0%
Total		86.3%	5.4%	5.9%	100.0%

The above table 6 indicates that on average 86.3 percent of students did not do any draft to solve two-step problems involving addition and subtraction while only 11.3 percent did the draft. But 5.4 percent draft was correct and 5.9 percent draft of those who did the draft was incorrect.

(II) Opinion of the Teachers

Table 7: Teachers face problems in teaching grade 3 mathematics

Respondent	Did the teacher face any problems in teaching grade-3 mathematics?		
	Yes	No	No comments
AT	68.75%	31.25%	0%
HT	62.50%	31.25%	6.25%

It is evident from the above table 7 and graph that the maximum number of teachers face problems in teaching grade 3 mathematics.

Table 8: Types of mistakes do the students make in doing addition with carrying and why.

Respondent	What types of mistakes do the students make in solving the following problems and why? 468 + 337							
	Mistakes			Why do the students make mistakes?				
	Addition with carrying	Fails to calculate	Make mistakes to write the result	Lack of knowledge about place value	Lack of attention	Forget to carry and add	Lack of practice	Irregular attendance
AT	87.50%	12.50%	0.00%	43.75%	25%	31.25%	12.50%	12.50%
HT	88%	25%	0%	37.50%	25%	50	25.00%	37.50%

According to the above table 8, more than 85% of respondent ATs and HTs opined that students fail to carry numbers from one's place to ten's place and also ten's place to hundred's place in the addition with carrying. Some of the respondents' ATs and HTs (12.50% and 25%) mentioned that students fail to calculate in the mentioned addition. As the reasons for students' mistakes, 43.75% ATs, and 37.50% HTs mentioned that students will make mistakes in doing mentioned addition due to their lack of knowledge about place value. 25% ATs and HTs mentioned that students will make due to their lack of attention. 31.25% ATs, and 50% HTs opined that students will make mistakes due to forgetting to carry and add from ten's place to one's place. Some of the respondent ATs and HTs mentioned that students will make mistakes due to their lack of practice and some of them mentioned students will make mistakes due to their irregular attendance.

Table 9: What types of mistakes do the students make in solving the subtraction with carrying and why?

Respondent	What types of mistakes do the students make in solving the following subtraction and why? 502 - 157							
	Mistakes			Why do the students make mistakes?				
	Subtraction with carrying	Fails to calculate	Can't write the numbers Properly	Subtract subtrahend from minuend	Make the mistake to write the result	Lack of knowledge about how to apply place value in subtraction	Lack of attention	Lack of understanding about subtraction procedure with how to borrow and return
AT	87.50	12.50	0.00	12.50	0.00	37.50	19	25.00
HT	75	13	32	0	13	43.75	6	37.50

According to the above table 9, 87.50% ATs, and 75% HTs stated that students will make mistakes to carry numbers from ten's place to one's place to do the subtraction. A small number of respondents ATs, and HTs mentioned that students will fail to calculate, while 32% HTs mentioned that students can't write the numbers properly to do the subtraction. A small number of respondents ATs stated that students can be subtracted subtrahend from minuend, while a small number of respondents HTs stated that students will make mistakes to write the result of the subtraction.

37.50% ATs and 43.75% HTs opined that students will make mistakes due to their lack of knowledge about applying place value in subtraction. 19% ATS, and 6% HTs opined that students will make mistakes due to their lack of attention. 25% ATs, and 37.50% HTs opined that students will make mistakes to do the subtraction due to their lack of understanding about subtraction procedure with how to borrow and return. 25% ATs and 12.50% HTs opined that students will make mistakes to do the subtraction due to their lack of attention, while 12.50% ATs and 37.50% HTs opined that students will make mistakes due to their irregular attendance.

Table 10: What types of mistakes do the students make in solving the word problem and why?

	Summary of the respondents' responses to the question of "Mother's age is 4 times more than the daughter. Before 4 years daughter's age was 6 years. What is mother's present age?"		
		Respondent	
Spontaneous	Students' errors	AT	HT
	Some students will make mistakes as 4×6=24 and then 24+4=28	50%	56%
Linguistic	Some students will write 4×6=24	43.75%	50%
	Some students will make mistakes as 4×6=24 and then 24-4=20	12.50%	12.50%
carelessness	Some students will answer only 4×4=16 16+6=22	25%	18.75%
	Reasons		
Lack of language comprehension skill	Some students can't understand the language of the problem	100%	100%
	Some of them can't understand the words after and before in the problem.	56%	25%
lack of carelessness	Some students are not attentive and careful in solving the problem	25%	18.75%
irregularity	Some students are irregular	25%	6.25%
lack of calculation skills	Some students can't do calculations properly	18.75%	0%

According to above table 10, teachers' knowledge about students' errors in the mentioned word problem is categorized as spontaneous, carelessness and linguistic. Results show that among the categories of errors, the prominent one is language comprehension error followed by spontaneous and carelessness errors. In the category of language comprehension error, 43.50% respondent ATs, and 50% HTs opined that students will make mistakes as 4×6=24, while 12.50% ATs, and 12.50% HTs opined that students will make mistakes as 4×6=24 and then 24-4=20. In the category of carelessness errors, 25% respondent ATs, and 18.75% HTs commented that students would make mistakes as 4×4=16 16+6=22.

The above table shows that as reasons for students' errors, teachers' responses are lack of language comprehension skills, lack of carelessness, irregularity and lack of calculation skills. The most prominent reason for students' errors in word problems is a lack of language comprehension skills. In the category, lack of language comprehension skills, all of the respondent ATs, and HTs opined that some students can't understand the language of the problem, while 56% ATs, and 25% HTs opined that some of the students can't understand the words '**after**' and '**before**' in the problem. In the category of lack of carelessness 25% ATs, and 18.75% HTs opined that some students are not attentive and careful in solving the problem. In the category of irregularity 25% ATs and 6.25% HTs opined that some students are irregular in the classroom. In the category of lack of calculation skill, 18.75% ATs opined that some students can't do calculations properly.

Table 11: How do teachers lead the learner for learning addition with carrying?

How do teachers lead the learner for learning addition with carrying?		
Teachers activities	AT	HT
Use fingers, flowers, a bundle of sticks, etc. as aids to clear students understanding of addition with carrying	0%	25%
Use concrete and semi-concrete objects to make the students' understanding about addition with carrying	37.50%	12.50%
Write an example of addition with carrying on the board and mention one, ten, hundred and calculate	12.50%	12.50%
Use related pictures to lead the students to understand addition with carrying	0%	12.50%
Use block card, number card for teaching addition with carrying	0%	12.50%
Lead the students to know the concept of place value for teaching addition with carrying	25%	0%
Students' Activities		
Students' do the addition with carrying on their notebook individually	31.50%	37.50%
Students themselves solve the problems by using their fingers and sticks	12.50%	43.75%
Students' do the addition with carrying in groups or pairs	75%	25%
Assess students' learning		
Students do addition individually	69%	75%
Students explain how to do addition with carrying	12.50%	19%
Students to do addition and check in pairs	18.75%	37.50%
Students to do addition on the board	19.00%	31%
Support for backward students		
Advanced learners support the backward learners	75%	62.50%
Backward students' get extra classes	12.50%	50%
Get individual help with teaching aids	12.50%	25%

According to above table 11, teachers lead the learners for learning addition with carrying is categorized as four significant areas: teacher's activities, students' activities, assess students' learning, and support for backward students. In the category of teacher's activities, 25% HTs and 25% HTs opined that teachers use fingers, flowers, a bundle of sticks, etc. as aids to clear students understanding of addition with carrying, 37.50% ATs and 12.50% HTs opined that teachers use concrete and semi-concrete objects to make the students' understanding about addition with carrying, 12.50% ATs and HTs opined that teachers write an example of addition with carrying on the board and mention one, ten, hundred and calculate, while 25% ATs opined that teachers lead the students to know the concept of place value for teaching addition with carrying.

In the category of students' activities, 31.50% Ats and 37.50% HTs opined that students do the addition with carrying on their notebook individually, 12.50% Ats and 43.75% HTs opined that students themselves solve the problems by using their fingers and sticks, while 75% ATs opined that students' do the addition with carrying in groups or pairs.

In the category of assessing students' learning 69%, Ats and 75% HTs made comments as students do addition individually, 12.50% ATs and 19% HTs made comments as students explained how to do addition with carrying, 18.75% Ats and 37.50% HTs made comments as students to do addition and check in pairs, while 19% ATs and 31% HTs made comments as students to do addition on the board.

In the category of support for backward students, 75% ATs and 62.50% HTs made comments as advanced students support the backward students 12.50% ATs and 50% HTs commented as backward students' get extra classes, while 12.50% ATs and 25% HTs commented as backward students get individual help with teaching aids.

Table 12: How do teachers lead the learner for learning addition with carrying?

How does the teacher lead the learner for learning multiplication?		
Teachers activities	AT	HT
Teach multiplication table	56%	75%
Explain the relation with multiplicand, multiplier, and product of multiplication	44.00%	50.00%
Teach the concept of multiplication by using pictures and charts.	25%	25.00%
Students' Activities		
Practice multiplication by using the multiplication table	62.50%	75.00%
Students solve different multiplication-related problems by memorizing the multiplication table.	13%	19%
Explain the relation with multiplicand, multiplier, and product of multiplication	19%	13%
Assess students' learning		
Students do multiplication individually	75%	69%
Students explain how to do multiplication by using a table	25.00%	19%
Students to do multiplication and check in pairs	12.50%	18.75%
Students to do multiplication on the board	19.00%	31%
Support for backward students		
Advance learners support the backward learners	63%	50.00%
backward students get extra classes	6.26%	25%
Get support with teaching aids to memorize the multiplication table	18.75%	25%
Explain the procedure of multiplication again on the board	12.50%	6.25%

According to above table 12, teachers' lead the learners for learning multiplication are categorized as four major areas: teacher's activities, students' activities, assess students' learning, and support for backward students. In the category of teacher's activities, 56% HTs and 75% HTs commented as teachers teach multiplication table, 44% ATs and 50% HTs commented as teachers explain the relation with multiplicand, multiplier, and Product of multiplication. In comparison, 25% of ATs and HTs commented that teachers teach multiplication using pictures and charts.

In the category of students' activities, 62.50% ATs and 75% HTs made comments as students practiced multiplication by using multiplication table, 13% ATs and 19% HTs

made comments as students solved different multiplication related problems by memorizing the multiplication table. In comparison, 19% ATs and 13% HTs commented as students explained the relation with multiplicand, multiplier, and Product of multiplication.

In the category of students assessed students' learning 63% ATs, and 50% HTs made comments as students do multiplication individually, 25% ATs, and 19% HTs made comments as students explained how to do multiplication by using the table, 12.50% ATs, and 18.75% HTs commented as students to do multiplication and check in pairs, while 19% ATs and 31% HTs commented as students do multiplication on the board.

In the category of support for backward students, 75% ATs, and 62.50% HTs made comments as advanced learners support the backward learners, 6.25% ATs, and 25% HTs commented as backward students' get extra classes, 18.75% Ats and 25% HTs commented as backward students get support with teaching aids to memorize the multiplication table, while 12.50% ATs and 6.25% HTs commented as explain the procedure of multiplication again on the board for backward students.

Table 13: Degree of using the lesson plan

Respondent	Does the teacher use LP in teaching grade 3 mathematics?						
	Everyday	5 days every week	4 days every week	3 days every week	2 days every week	1 day in a week	Not use
AT	68.75%	0%	18.75%	0%	12.50%	0%	0%
HT	50%	18.50%	6.25%	6.25%	6.25%	6.25%	6%

According to above table 13, it shows that 68.75% Ats and 50% HTs stated that teachers use lesson plans every day, 18.50% HTs stated that teachers use lesson plan 5 days every week, 18.75% ATs and 6.25% HTs stated that teachers use lesson plan 4 days every week, 6.25% HTs stated that teachers use lesson pan 3 days every week, 12.50% ATs, and 6.25% HTs stated that teachers use lesson plan 2 days every week and 6.25% HTs stated that teachers use lesson plan 1 day every week, while 6% HTs stated teachers don't use a lesson plan.

Table 14: What materials do the teachers use for preparing LP?

Respondent	What materials do the teachers use for preparing LP?						
	TB	TA	Teaching Package	Curriculum	Others	TB	TA
AT	100%	100%	18.75%	0%	12.50%	AT	100%
HT	100%	100%	18.75%	18.75%	12.50%	HT	100%

According to the above table 14, all of the respondent Ats and HTs opined that teachers use the textbook, while all of the ATs and HTs opined that teacher's use teacher's edition for preparing a lesson plan, 18.75 ATs and HTs opined that teacher's use teaching

package for preparing a lesson plan and only 18.75% HTs mentioned that teacher's use curriculum for preparing a lesson plan.

Table 15: Degree of using teaching aids

Respondent	Degree of using Teaching aids						
	Every day	5 days in a week	4 days in a week	3 days in a week	2 days in a week	1 day in a week	Not use
AT	50%	25%	6.25%	6.25%	12,50%	0%	0%
HT	62.50%	6.25%	6.25%	6.25%	6.25%	0%	0%

According to the above table 15, 50% ATs, and 62.50% HTs stated that teachers use teaching aids every day in a week, 25% ATs, and 6.25% HTs stated that teachers use teaching aids 5 days a week. 6.25% ATs and HTs stated that teachers use teaching aids 4 days a week. 6.25% ATs and HTs stated that teachers use teaching aids 3 days a week. 6.25% HTs and stated that teachers use teaching aids 2 days a week.

Table 16: Degree of provided support to teachers by related stake-holders

Respondent	The degree of support is got from related stakeholders for enhancing the quality of mathematics teaching-learning.									
	Subject knowledge	Curriculum	Preparing LP	Collecting and pre-paring TA	Effective use of TB during teaching-learning	Teaching method and techniques	Student-centered method	Effective use of black-board	Assigned creative work for students	*Effective evaluatio n*
AT	56%	45%	43%	50%	56%	45.00%	45%	56%	35%	*50%*
HT	50%	43%	50%	57.50%	50%	50%	45%	45%	35%	*50%*

The degree of provided support by related stakeholders are categorized into 10 areas as subject knowledge, curriculum, preparing a lesson plan, collecting and preparing teaching aids, effective use of textbook, teaching method and techniques, student-centered method, effective use of the blackboard, assigned creative work for students and effective evaluation. It is evident from the above table and graph, in the area of subject knowledge Ats and HTs, degrees of provided support to teachers is 56% and 50% respectively, in the area of the curriculum are 45% and 43%, in the area preparing lesson plan are 43% and 50%, in the area of collecting and preparing lesson plan are 50% and 57.50%, in the area of effective use of textbook are 56% and 50%, in the area of teaching methods and techniques are 45% and 50%, in the area of the student-centered method are 45% and 45%, in the area of effective use of blackboard are 56% and 45% in the area of assigned creative work are 35% and 35% and in the area of effective evaluation are 50% and 50% respectively.

Table 17: Degree of satisfaction in teaching grade 3 mathematics

Respondent	Degree of satisfaction in teaching grade 3 mathematics					
	Not satisfied	Satisfaction is very low	Satisfaction is low	satisfied	Very much satisfied	Fully satisfied
AT	0%	0%	87.50%	12.50%	0%	0%
HT	6.25%	6.25%	31.25%	50%	6.25%	0%

According to the above table 17, the degree of satisfaction in teaching grade 3 mathematics is categorized into 6 levels as not satisfied, satisfaction is very low, low, satisfied, very much satisfied, and fully satisfied. It shows that 87.5% ATs' ratio of satisfaction is low and 12.50% ATs are satisfied in teaching grade 3 mathematics. It is also evident that 6.25% HTs are not satisfied, 6.25% HTs satisfaction is very low, 31.25% HTs satisfaction is low, 50% HTs are satisfied and 6.25% are very much satisfied in teaching grade 3 mathematics,

Table 18: Teacher's techniques of teaching subtraction with carrying

What did teachers do to teach the subtraction of			502 (-) 157	
Did subtraction with an explanation on the board	Did subtraction with analysis method	Did subtraction with addition method	Use teaching aids to teach	Forget
86.67%	13%	40%	20%	0%

It is evident from the above table 18, 86.67% of students mentioned that teachers did subtraction with an explanation on the board, 13% mentioned that teachers did subtraction with analysis method, 40% mentioned that teachers did subtraction with addition method, 20% mentioned that teacher's use teaching aids to teach the subtraction.

(III) Results from FGD

Table 19: Teacher's techniques of teaching word problem

What did the teacher do to teach the problem like "Mother's age is 4 times more than daughter's. 4 years before daughter's age was 6 years. What is mother's present age?"		
Let the students read the problem	Solve the problem on the board and ask the students to copy the solution on their notebook	forget
6.67%	60%	33%

It is evident from the above table 19, 6.67% of students mentioned that teachers let the students read the problem, 60% mentioned that teachers solve the problem on the board and ask the students to copy the solution on their notebook and 33% mentioned that they forget how did teachers teach such type of problem.

Table 20: What did the students do if they could not understand any content?

What did the students do if they could not understand any content?			
Ask the teacher	Ask the students beside	Don't ask the teacher	No answer
53%	13%	7%	40%

It is revealed from the above table 20, 53% of respondent students mentioned that they asked the teacher, 13% asked the students beside and 7% didn't ask the teacher, while 40% didn't answer.

Table 21: What does the teacher do if students can't understand any content?

Help us to understand with explanation	53%
Sometimes punish the students	13%
Use advanced students to help us.	20%
Solve the problem on the board and explain again.	47%
Let the students practice again and again	27%
Use advanced students' notebooks.	7%
Give home task.	7%

It is revealed from the above table 21 that 53% of students mentioned that teachers help them to understand with explanation, 13% mentioned that sometimes teachers punish the students, 20% of students mentioned that teachers use advanced students to help, 47% mentioned that teachers solve the problem on the board and explain, again and again, 27% mentioned that teachers let the students practice, again and again, 7% mentioned that teachers use advanced students' notebook and 7% mentioned that teachers give the home task to the students who do not understand any content.

(IV) Result of lesson observation

Table 22: Lesson Observation

Sl. no	Activities	No performance	Showing little performance	Showing good performance	Showing a very good performance	Showing high-quality performance
		0	1	2	3	4
1	Enter the classroom according to the allocated time in the routine and creating safety environment		13.33%	20%	53.33%	13.33%
2	Ensure related necessary materials and equipment are available in the classroom	6.67%	26.67%	53.33%	26.67%	
3	Ensure seating arrangement for implementing plan wise activities		20%	40%	13.33%	26.67%
4	Conducting lessons according to the plan		26.67%	60%	13.33%	
5	Testing previous knowledge through questions related to the present lesson	6.67%	20%	33.33%	33.33%	6.67%
6	Explain the objectives and achievement of the lesson	13.33%	40%	20%	26.67%	

7	Properly and clearly explain the content of the lesson	6.67%	26.67%	46.67%	20%	
8	Teachers present the key question at the very beginning of the lesson	13.33%	26.67%	40%	20%	
9	Showing real-life example to make the problem easy	13.33%	40%	33.33%	6.67%	6.67%
10	Drawing diagram/picture to make the problem easy and understandable	40%	26.67%	13.33%	20%	
11	Let the students think and solve the problem in their notebooks.		33.33%	46.67%	20%	
12	Teacher's techniques of using chalkboards are well planned and student-centered	6.67%	20%	60%	13.33%	
13	Help them to solve assigned problem in pair/group	33.33%	40%	20%	6.67%	
14	Properly monitor the group work and provide the necessary support	20%	26.67%	46.67%	6.67%	
15	Encourage students to solve the problem in different ways	13.33%	46.67%	20%	20%	
16	At every step Teacher lets the students explain ways of solution.	20%	46.67%	20%	13.33%	
17	The teacher ask open-ended/closed questions		60%	33.33%	6.67%	
18	Teacher answer students every questions	20%	33.33%	46.67%		
19	Teachers encourage students to ask question	20%	53.33%	26.67%		
20	Teachers complete every step of the lesson maintaining time	20%	60%	6.67%	13.33%	
21	Teachers provide activity sheets to students	33.33%	53.33%	13.33%		

22	Teachers praise students for every performance		53.33%	33.33%	6.67%	6.67%
23	Effectively use the textbook		40%	46.67%	13.33%	
24	Teachers evaluate students after every step and finally at the end of the lesson.		33.33%	46.67%	20%	
25	Teachers summarize the learning of the lesson and conclude with praising students.	26.67%	40%	20%	13.33%	
26	Assign home work for every student	26.67%	13.33%	26.67%	26.67%	6.67%

It is revealed according to the above table 22, more than 50% observed teachers' performance is very low and some of the teachers' performance is good in some activities and a very small number of teachers' performance is very good in some activities, whereas a few teachers' performances is excellent in some activities.

7. Findings

(I) Findings Achievement Test

1. Students' performance of urban is better than rural in the concept of ordinal numbers, while the average performance of both rural and urban students is not satisfactory (45.7%).
2. On average, most students (65.7 percent) have the concept of adding two numbers up to three digits correctly. The study also found that urban students performed better than rural students (75.6% urban and 55.7%).
3. On average, the majority (64.0 percent) of students have the concept of subtraction from some three digits to a smaller number of not more than three digits correctly. The study also found that urban students performed better than rural students in this competence (74.2% urban and 53.6%). It is also revealed that although it is important to draft for identifying the correct answer a very small percentage of students did the draft(37.2%) and among them, only 28.5% drafted correctly.
4. On average, only 31.2 percent of students have the concept of identifying the multiplicand, multiplier, and product in a sum involving multiplication operation correctly, while 62.2% could not. The study also showed that a very similar percentage of urban and rural students (34.4% & 28.0%) have the concept of identifying multiplicand, multiplier, and product in a sum.
5. Dividend, divisor, quotient, and reminder in a division sum correctly while more than students (47.9%) couldn't.
6. On average, only 42.0 percent of students can divide a three-digit number by a one-digit number correctly while more students (46.1%) couldn't.
7. On average, only 38.8 percent of students can correctly identify and tell dividend, divisor, quotient, and the remainder in a division sum, while more than students (49.2%) couldn't. It is also revealed that a very similar percentage of students (49.5%

and 48.8%) urban and rural students couldn't answer correctly. It means weaknesses in division sum still exist among the majority of students in grade 3 in the sampled area.

8. On average only 39.1 percent of students have the capability of solving word problems related to division correctly It is also found that the urban students' scores (44.3.0%) were around 11.5 more than on average than the rural students' scores (33.8%).

(II) Findings from Teachers' Interview

9. The maximum number of teachers face problems in teaching grade 3 mathematics.
10. The maximum number of respondents opined that student fails to carry number from one place to ten's place and also ten's place to hundred's place in the addition with carrying, while some of them opined that students' fails to calculate and make mistakes to write the result in the addition with carrying.
11. As the reasons for students' mistakes, some of the respondents' Ats and HTs mention that students will make mistakes in doing addition with carrying due to their lack of knowledge about place value and some of them mentioned that students would make mistakes due to their lack of attention, due to forgetting carry and add from ten's place to one's place and due to their irregular attendance.
12. The maximum number of respondents stated that students would make a mistake to carry number from ten's place to one's place to do subtraction with carrying, while a small number of respondents mentioned that students would fail to calculate, students can't write the numbers correctly, students can be subtracted from minuend and students will make a mistake to write the result of the subtraction.
13. Respondents' (Ats and HTs) knowledge about students' errors in the word problem are categorized as spontaneous, carelessness, and linguistic. Among the categories of errors, the prominent one is language comprehension error, followed by spontaneous and carelessness errors.
14. As the reasons for students' errors, respondents' response is lack of language comprehension skills, lack of carelessness, irregularity, and lack of calculation skills. The most prominent reason for students' errors in word problems is lack of language comprehension skills followed by lack of carelessness, attentiveness, calculation skill, and irregularity.
15. It is found that a small number of students do the addition with carrying on their notebook individually and students themselves solve the problems by using their fingers and sticks as the activities of students. It is also found that most of the students' do the addition with carrying in groups as the activities of students.
16. Most of the students do addition individually as the activity of students' assessment. Some of these students do addition and check in pairs and some of them do addition on the board, while some of the students explain how to do addition with carrying as the activity of students' assessment.
17. Most of the respondents made comments as advanced students support the backward students, while some of the respondents commented as backward students' get extra classes and individual help with teaching aids.
18. It is found that most of the teachers teach multiplication tables for teaching multiplication, while some of the teachers use pictures, charts and explain the relation with multiplicand, multiplier, and product of multiplication to teach the concept of multiplication.
19. More than half of the respondents opined that students practice multiplication by using a multiplication table, while some of the respondents opined that students solve

different multiplication-related problems by memorizing multiplication tables as the students' activities in the classroom.

20. Around half of the respondents commented as students doing multiplication, while some of them commented as students explaining how to do multiplication by using tables and students doing multiplication on the board as the activity of assessing students' learning.
21. Most of the respondents commented as advanced students support the backward students, while some of the respondents commented as backward students get extra classes, backward students get support with teaching aids.

(III) Findings from Students Focus Group Discussion

22. Most FGD students' interest in mathematics is very good and some of the students' interest is good.
23. More than half of the FGD students like mathematics because mathematics is easy, while some of them mentioned that they like mathematics because of teacher help them to understand, teacher's teaching techniques is good, teacher personally help them, math is important for business, can get good marks and mathematical problems are written in Bangla.
24. The maximum number of FGD students mentioned that teachers did subtraction with the explanation on the board, while some of them mentioned that teachers did subtraction with analysis and addition method with teaching aids.
25. The maximum number of FGD students mentioned that teachers solve the problem on the board and ask the students to copy the solution in their notebooks.
26. More than half of the students asked the teacher and some of them asked the students if they could not understand any concept of the mathematics lesson.
27. Around half of the students mentioned that teachers help them understand with explanation and solve the problem on the board, while some of them mentioned that they use advanced students to help the backward students and let the students practice again and again.
28. More than half of the observed teachers' performance in mathematics lessons is very low and some of the teachers' performance is good in some activities and a minimal number of teachers' performance is very good in some activities, whereas a few teachers' performances are excellent in some activities.

(IV) Findings from Classroom Observation

29. More than half of the teachers use lesson plans every day in a week, while some of the teachers don't use a lesson plan.
30. All of the teachers use textbooks and teacher's editions for preparing a lesson plan, while some of the teachers use a teaching package for preparing a lesson plan and some of them use the curriculum for preparing a lesson plan.
31. More than half of the teachers use teaching aids every day in a week, some of them use five days, some of them use four days, some of them use three days and some of them use teaching aids in a week, while some of the AUEOs opined that teacher doesn't use any teaching aids in the classroom.
32. The mean score of the provided support of ATs and HTs to teachers in every area of subject knowledge, curriculum, preparing a lesson plan, collecting and preparing teaching aids, effective use of textbook, teaching method and techniques, student-centered method, effective use of the blackboard, assigned creative work for students

and practical evaluation is around 50 percent and in some areas are around 40 percent.

33. Most of the respondent's ATs and HTs satisfaction in teaching mathematics in grade-3 is low.
34. As the suggestions for improving the quality of mathematics teaching-learning, a small number of respondents opined that teachers need to ensure activity-based learning opportunities. Teachers should prepare and follow the lesson plan and ensure effective use of teaching aids related to the lesson. Some of the respondents also mentioned that it is necessary to arrange subject-based math training every year and increase the duration of training for improving mathematics teaching-learning, ensure continuous academic supervision and monitoring, extend the duration of the math lesson, need to enhance students reading ability for improving mathematics teaching-learning. It also found from the respondents' opinion that teachers should have explicit knowledge about curriculum and content and classroom facilities should be ensured for improving mathematics teaching-learning.

Recommendations

1. Sufficient pictures, diagrams, number lines regarding place value should be incorporated to solve the mathematical operations in classroom teaching.
2. Emphasis should be given to basic language skills for a better understanding of mathematical problems.
3. It is very essential to ensure preparing and using lesson plans in every lesson.
4. In mathematics lessons, teachers have to follow a student-centered approach, using teaching aids, collaboration in solving problems, discussion, and feedback.
5. Ensure continuous monitoring, mentoring, and supervision for enhancing the quality of mathematics teaching-learning.
6. Different joyful supplementary activities should be integrated into mathematics teaching-learning.

Conclusion

This article provides information to minimize the weakness of Mathematics in grade 3 students by incorporating sufficient pictures, diagrams, and number lines and providing different joyful supplementary activities in the teaching-learning process. This research article revealed a new horizon to the teachers' educators, policymakers, teachers of the primary school of Bangladesh, and a new insight to support primary school teachers. Further study can be possible in the future to ensure quality primary mathematics education in Bangladesh.

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