

Analysis of Primary Mathematics in Bangladesh from Pupils' and Teachers Perspectives — Focusing on Fraction —

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Most of the developing countries are now engaged with enlargement of pupils' participation in school under the initiative of UNESCO (1990). And it also emphasizes the good quality of education which they receive at school. Bangladesh is also engaged with this task. Three major factors of education are pupils, teacher and teaching materials. So, this research sought to investigate on the quality of education, especially mathematics education from angles of both pupils and teachers, by focusing on conceptual understanding of the fraction as teaching material. As a conclusion, three points were found out as follows: (1) uneven distribution of weak areas for pupils, and this tendency is not uniform between urban and rural schools, (2) very few pupils were able to explain the sentence of problem, and this is a manifestation of rote learning without proper understanding, and (3) teachers' less attention to pupils' difficulty and understanding level. And therefore in future teaching method should be tailored according to their needs.

1. Background

Currently UNESCO plays a leading role in promoting primary Education for All people (Commonly termed as EFA) in the world. It started in 1990 with the conference which attracted hundreds of education-related people for the developing countries. There was a serious recognition that there were more than 100 million people, who were expected to go to school at their age but did not. Since primary education promote individual human right and minimum capability to work in modern society, this situation was terrifying and so it has prompted them to take some measures against it. Not only going to school but also having quality education in school are very important, but the latter aspect is sometimes neglected in the discussion. Otherwise, they simply go to school physically but not psychologically. This research is to target at analyzing the qualitative aspect of primary mathematics education in Bangladesh under this sense of issue.

Bangladesh is one of the most populous countries in the world, and occupies an important position for attainment of the above ideal, EFA. Historically, she regards the primary education as a means of reducing poverty and improving the quality of life. In the 1st drive, First Five Year Education Plan in Bangladesh (1973-78) proposed to establish 5000 new primary schools just after the independence in 1973. During this

period, the government felt it necessary to make primary education compulsory with the basic goals of illiteracy eradication and realization of Universal Primary Education (UPE). In order to implement these policies, the government undertook various programs/ projects with her resources and also with assistance of development partners.

She continued this effort since then, and had been engaged in an innovative program 'Primary Education Development Program' (PEDP-I) between 1998 and 2003. The major objectives of the program were to improve school quality and system efficiency, to establish a sustainable, cost-effective and better-managed education system and to ensure universal coverage and equitable access to quality education. In consequence, amazing success was achieved in enrollment at primary level and it reached at 97% by 2002 (Directorate of Primary Education, 2002). In respect of qualitative aspect, however, the achievement was far away from the satisfaction. Therefore, by putting more focus on qualitative aspect of education, the Second Primary Education Development Program (PEDP-II, 2003-2008) is built on the achievements of the past decade, and especially on those of PEDP-I. In short, it reflects the government's goals for quality primary education for all.

Three major factors of education are pupils, teacher and teaching materials. In this research, we would like to analyze the status of quality primary education, which she has been working for. More specifically, since numeracy forms an important part of quality education (UNESCO, 1990), the objective of this research is to identify the present status of mathematics education, which nurtures numeracy for pupils, at primary level in Bangladesh both from pupils' and teachers' perspectives. This research also forms a part of international comparative studies, which are supported by the fund acknowledged at the end of the paper.

2. Research Method

This research sought to investigate on the quality of education, especially mathematics education from angles of both pupils and teachers, by focusing on conceptual understanding of the fraction as teaching material. It chose fraction as a research area due to the following reasons:

- 1) It is regarded as the first topic toward abstract mathematics,
- 2) It is a common topic for all the participating countries to the above international studies, and
- 3) It is from the dominant number domain in these countries

The preliminary survey was conducted in 2004 and the following problems were identified.

(Pupils)

- * Level of understanding
Generally poor, Disparity between rural and urban schools and the one between female and male pupils
- * Degree of acclimation to the sentence problem
Pupils seem not to be accustomed to sentence problems.
- * Implicit examination orientedness
Examination pre-occupies pupils' and teachers' concern.

(Teachers)

- * Gap between teachers' confidence in teaching and pupils' actual achievement
 Regardless of pupil's performance, teachers have confidence in teaching. Teaching and learning are not very connected.
- * Meaning of teaching
 Teaching is inclined to repeat simply what is written on the textbook.
- * Belief in textbook
 Teaching is largely based on teaching textbook. And teachers pointed out that the patterns of the test items are different from those in the test.

In order to seek more closely the above problems we developed three research tools to collect data regarding pupils and teachers. They are namely achievement test (ANNEX 1), interviews items for pupils (ANNEX 2) and questionnaires for teachers (ANNEX 3). The achievement test was to inquire weakness of pupils especially in understanding concept of fraction, using sentence problems. New types of problems were included in order to examine the relation between performance in this test and that in their usual problems. The interview item was developed to identify linguistic weakness of pupils in the sentence problems, which are included in the test. Questionnaires were designed to identify teachers' perception about pupils, teaching and textbook. in relation with the test. All of them are translated into the national language, Bangla, and interview and explanation were conducted in that language. Period of field survey was 9th November, 2005 to 17th November, 2005.

Regarding selection of samples, we took the following procedure. In Bangladesh, Government Primary Schools (GPSs) are categorized into four levels such as A, B, C, and D. This categorization is done based on overall performance, consisting of such items as School Management Committee (SMC), Parent-Teachers Association (PTA), Scholarship examination result, playground, plantation, scout group etc. About half of the schools belong to B category, and therefore it can be regarded as an average performance. So, two sample schools were chosen from this category with consultation of local authority. They are one GPS from an urban area and one GPS from a rural area in Mymensingh district. The urban school is situated in the center of Mymensingh and the rural one is situated about 30 kilometers away from the center. Since this is a continuation of the preliminary study, all grade 5 pupils, who have been chosen as a sample in the preliminary study, were chosen again in this study. The details about the sample are shown in the Tables 1 and 2. There are four teachers as a sample. Two teachers taught the grade 5 at that year and two more teachers taught at the previous year. There is no subject- based teaching at the primary level in Bangladesh.

So basically these teachers have to teach all the subjects. All of them have C-in-Ed (Certificate in Education) training in PTI (Primary Training Institute) for one year.

Table 1. Number and distribution of sample pupils

	Grade	Boys	Girls	Age	Total
Urban School	5	8	16	10-13	24
Rural School	5	11	12	10-14	23
Total	—	19	28	10-14	47

Table 2. Number and characteristics of sample teachers

	Sex	Duration of teaching	Subjects to teach
Urban School	*Male	14 years 5 months	All subjects
	Female	29 years 10 months	Mathematics, Bangla
Rural School	*Female	10 years 5 months	Mathematics, Social studies, Science
	Female	5 years 5 months	Mathematics, English, Bangla

* At present mathematics class teacher at Grade 5.

3. Result of Research and its Discussion

3-1 Achievement Test

Result of achievement test is listed as follows. Table 3 shows the overall result of achievement test. Since the sample size was small, we didn't conduct statistical test but did descriptive statistics. The average score is 42.9%. Comparatively urban school pupils' performance (average score 51.7%) is better than rural school pupils' performance (average score 33.7%). The question-wise analysis (Table 4) reveals that in general, pupils' performance is comparatively better in Q1 (2), Q3 (1), Q4 (1), and Q6 (1). It seems that to some extent pupils are familiar with these types of question as the classroom test. In general the difficult problems are Q4 (2), Q5 (1), Q5 (2), Q5 (3), Q6 (3), and Q10.

Table 3. Results of the achievement test

	Average	Boys	Girls	Highest	Lowest
Urban School	51.7%	55.3%	49.9%	68%	34%
Rural School	33.7%	33.8%	33.6%	53%	11%
All	42.9%	42.8%	42.9%	68%	11%

Table 4. Question-wise achievements of pupils in percentage

	Coverage (Grade)	School in urban area			School in rural area		
		Combined	Boys	Girls	Combined	Boys	Girls
Q1 (1)	5	91.60%	100%	87.50%	30.40%	54.50%	8.30%
Q1 (2)	5	89.50%	93.70%	87.50%	60.80%	63.60%	58.30%
Q2	5	54.10%	37.50%	62.50%	0%	0%	0%
Q3 (1)	3	96.50%	100%	94.70%	40.50%	36.30%	44.40%
Q3 (2)	3	79.10%	75%	81.20%	26.80%	6.10%	45.80%
Q4 (1)	5	92.70%	100%	89%	69.50%	43.10%	93.70%
Q4 (2)	5	0%	0%	0%	18.40%	29.50%	8.30%
Q4 (3)	5	33.30%	37.50%	31.20%	16.30%	25%	8.30%
Q5 (1)	*	35.40%	50%	28.10%	13%	9.10%	16.60%
Q5 (2)	*	2.10%	0%	3.10%	21.70%	45.40%	0%
Q5 (3)	*	6.20%	6.20%	6.20%	19.50%	9.10%	29.10%
Q6 (1)	5	94.70%	96.80%	93.70%	38%	37.50%	38.50%
Q6 (2)	5	51.50%	98.40%	28.10%	28.20%	19.30%	36.40%
Q6 (3)	5	0%	0%	0%	13%	9.10%	16.60%
Q7	4	27.10%	18.70%	31.20%	15.20%	31.80%	0%
Q8	X	58.30%	50%	62.50%	69.50%	81.80%	58.30%
Q9	X	60.40%	62.50%	59.30%	58.60%	54.50%	62.50%
Q10	X	12.50%	0%	18.70%	8.60%	18.10%	0%

Legend: * it is covered but question pattern is different from Bangladesh pattern, X: it is not covered

The most difficult question for urban school pupils are Q4 (2), Q5 (2), Q5(3), and Q6 (3), and their average scores are respectively 0%, 2.1%, 6.2%, and 0% below 10%. On the other hand, the most difficult question for rural school pupils are Q2 and Q10, and the average score is 0% and 8.6% respectively. According to the teachers, some of the above question-patterns are not the same as those in textbook or classroom test. Rural school pupils' performance is comparatively better in Q4 (2) and Q6 (3) than urban school pupils' performance despite overall poor performance. The reasons behind this might be that rural school pupils help their parents for measuring in their agricultural works, and so they are familiar with these items. On the other hand, urban school pupils' performance is comparatively better in Q2 than rural school pupils' performance.

The reasons behind this might be rural pupils' less conceptual understanding of this topic.

3-2 Result of Interviews to Pupils using Newman Procedures

In order to explore further the linguistic and conceptual difficulties which pupils are facing, we employed Newman procedure (Natcha & Nakamura, 2006) for an interview. Here we modified the original Newman procedure in such a way that we proceeded to the next step of interviewing to pupils, even if they were not able to explain the meaning or select mathematical operation. This is because some students showed correct answer through guess work without proper understanding of the problem, and this is believed as an important characteristic.

We have selected ten pupils for interview on the basis of their exam result about mathematics in the previous term. Five of them acquired good grade and the other five acquired poor grade. The interview items for pupils are divided into the following three levels (a) reading, (b) understanding of concept, (c) process, and (d) specific mistakes (if any).

(a) Reading level (Simple recognition of words and symbols):

"Can you read the question?"

(b) Comprehension level (Linguistic interpretation of problems):

"Can you understand and explain the meaning of the question verbally?"

(c) Process skills level (Understanding and Execution of mathematical operations or procedures):

"Can you select and perform mathematical operations or procedures?"

Table 5 shows which level the pupils' error occurred at in urban and rural schools. The items Q5 (3), Q6 (1), and Q8 are selected for the interview in terms of criteria, in which sentence problem requires linguistic interpretation and transformation to mathematical process. According to the findings, all pupils could read the sentences somehow with a little difficulty, but none of them could understand the concept of Q5 (3), Q8 and less than half of them could understand the concept of Q6 (1). As for the process skill, in Q5 (3) most of them could not show the correct process, and in Q6 (1) and Q8 half of them could not show the correct process.

Table 6 shows which level the pupils' error occurred at according to their performance. In the process skill, high performers solved more problems than low performers in Q5 (3) and Q6 (1), but in Q8 poor performers answered 3/5 by simple combination of given numbers without much consideration.

In Q5 (3), the pupils of both schools felt difficulty to read the words "correct" and

Table 5. Pupils' level of errors by location

Q. No.	No. of errors per solving level									No. of correct answer		
	(a) Reading			(b) Understanding of Concept			(c) Process					
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Q5 (3)	-	-	-	10	10	20	10	9	19	0	1	1
Q6 (1)	-	-	-	6	6	12	2	8	10	8	2	10
Q8	-	-	-	10	10	20	6	8	14	4	2	6

Table 6. Pupils' level of errors by performance

Q. No.	No. of errors per solving level									No. of correct answer		
	(a) Reading			(b) Understanding of Concept			(c) Process					
	High performer	Low performer	Total	High performer	Low performer	Total	High performer	Low performer	Total	High performer	Low performer	Total
Q5 (3)	-	-	-	10	10	20	9	10	19	1	0	1
Q6 (1)	-	-	-	3	9	12	4	6	10	6	4	10
Q8	-	-	-	10	10	20	9	5	14	1	5	6

Table 7. Remarks by researchers

		Difficult words	regarding problem solving process
Q5(3)	High performer	"Correct", "appropriate"	1. $1/4$ is greater than $1/3$, since 4 is greater than 3. 2. A: $1/4$, B: $1/3$: A=B
	Low performer	"Correct", "appropriate"	1. $1/4$ is greater than $1/3$, since 4 is greater than 3. 2. A: $1/4$, B: $1/3$: B=A
Q6 (1)	High performer	"Process"	1. Added the numerators and denominators. He/she has no idea regarding fraction.
	Low performer		1. Calculation is accurate but could not explain the process. 2. Wrote the process but could not find out the solution.
Q8	High performer	"Relationship", "in terms of", "Bracket"	1. Pupils have no idea how to find out the relationship.
	Low performer	"Bracket"	1. Pupils have no idea how to find out the relationship. Only wrote the answer that was $5/3$. 2. Only wrote the answer.

“appropriate”. They did some mistakes in the process skill. For example, some of the given reasons are such as “ $1/4$ is greater than $1/3$, since 4 is greater than 3” and “if a denominator is greater than other denominator then that fraction is bigger than other fraction”. In Q6 (1), the pupils of rural school felt difficulty to read the word “process”. They did some mistakes in the process skill. For example, they added the numerators and denominators to find out the solution. In Q8, the pupils of both schools felt difficulty to read the words “relationship”, “in terms of”, “bracket”. They did some mistakes in the process skill. For example, they only wrote the answer that was $5/3$ instead of showing any process.

Thus, the number of correct answers does not tell us the exact number who really understood the meaning and followed correct solving process of the problem. In other words, there are certain numbers of correct answers by chance without proper thinking. This is a very important point in considering quality education.

3-3 Results of Questionnaires to Teachers

We conducted questionnaire to teachers as well, regarding the pupils' understanding and their teaching in fraction. The questionnaire items are divided into the following five categories (a) test-evaluation (b) self-evaluation (c) pupils-evaluation (d) contents-evaluation and (e) teaching-methodology.

(a) Test-evaluation

According to the test evaluation items, urban and rural school teachers' estimations on the average score of pupils are 70% and 33% respectively. The former's high perception on pupils' performance does not match the pupils' actual score (42.9%) of achievement test.

Teachers in both schools mentioned unfamiliarity of problems. Pupils are not accustomed to this type of question unlike their classroom test, which are almost the same as textbook contents. This tendency was not confirmed as the Table 8 showed. This table corresponds with Table 4, and the average score is calculated among items within the same curriculum coverage. For example, the average of all items in grade 3, that are Q3 (1) and (2), is calculated.

Table 8. Average score per grade

Grade	3	4	5	*	X
Average	61.30%	21.20%	43.70%	16.30%	44.60%

Legend: “*” it shows the item(s) covered but question pattern is different from Bangladesh pattern.
 “X” shows the item not covered in Bangladesh.

(b) Self-evaluation

In response to the item (4) on self-evaluation, the teachers stated that they feel difficulties in teaching “Fraction”. Some of the reasons behind this are “pupils can easily understand the whole numbers but they find it is difficult to understand the concept of fraction”, “practical use of fraction is difficult”, “fraction related real/concrete materials are limited in the classroom”. From a different angle, teachers reported in the item (5) that there are the most difficult topics to teach in Grade 5 such as geometry, simple fraction, decimal fraction, highest common factor and least common multiple. Some of the reasons for this are “lack of prior knowledge”, “lack of proper reflection of

pupils' demand in the textbook", "pupils cannot memorize the formula". Upon reflection on the answers together with those for the easiest topic, teaching-learning materials such as textbook, exercises and real/ concrete materials seem to be necessary for understanding concept, and familiarity and interests in topics concept can be regarded as key for easiness.

(c) Pupils-evaluation

In response to the items (9) and (10) on pupils-evaluation, the teachers said, it is easy for the pupils to learn fractions although they also mentioned some difficult points

Table 9. Teachers' perception on the achievement test and teaching of Mathematics

Items No.	Average school in urban area	Average school in rural area
(4) Difficulties in teaching "Fractions".	Easy (1), difficult (1) Reason/s:	Difficult (2) Reason/s: 1. Pupils can easily understand the integer number but they find it is difficult to understand the concept of fraction. 2. Practical use of fraction is difficult. 3. Fraction related real/concrete materials are limited in the classroom teaching.
(5) The most difficult topic/s to teach in Grade 5.	Topic(s): Geometry, simple fraction and decimal fraction Reason/s: 1. Lack of prior knowledge 2. Lack of proper reflection of pupils' demand in the textbook. 3. Exercises are difficult to understand and to solve.	Topic(s): Highest common factor (2), least common multiple (2), measurement (2), simple fraction and decimal fraction (2) Reason/s: 1. Pupils cannot memorize the formula. 2. It is hard to explain about these topics without having the real/concrete materials.
(6) The easiest topic/s to teach in Grade 5.	Topic(s): Addition (2), subtraction (2), multiplication and division related problems; the highest number and the lowest number; average Reason/s: 1. Pupils are previously familiar with these topics. 2. Pupils are more interested towards well-known topics. 3. These topics are not so difficult and therefore easy to understand.	Topic(s): Unitary method (2), simplification (2), average (2), percentage, time Reason/s: 1. These topics are more related to real life. 2. Easy to explain.
(9) Degree of difficulty for the pupils	Easy (2)	Easy (2)
(10) Points of difficulty for the pupils to learn the concept of "Fractions?"	1. To differentiate the types of fractions 2. To convert into fraction 3. To fragment of fraction	1. To find out the least common multiple. 2. To convert into equal denominator. 3. To write the fraction on notebook.
(11) Pupils' difficulty with the medium of instruction	No (2)	No (2)
(12) Importance of learning "Fractions" with comparison to any other topics in mathematics.	Yes (2) Reason/s: 1. If the idea of fraction is not clear at the initial level then it hampers the pupils' academic acquisition and practical life. 2. To solve the mathematical problems the use of fraction is noteworthy. 3. Pupils are able to know about larger, smaller, comparing things etc. through fraction.	Yes (2) Reason/s: 1. Fraction is an inseparable part of mathematics. Integer number is formed bringing together the fragmented parts. That's why it is important.
(13) Teacher's main point/s of concern to the pupils in teaching "Fractions?"	The main points is the concept of fraction, numerator and denominator, types of fraction, the relationship of numerical size of numerator & denominator with types of fractions	The main points is the numerator and denominator, different types of fractions

Legend: () parenthesis denotes the number of respondent

to learn such as types of fractions, to find the least common multiple, and to convert into equal denominator. From these teachers seemed to pay attention to knowledge and skills aspect of fraction. Nevertheless, they said in item (11) that they are confident to teach fraction.

(d) Contents-evaluation

In response to the items (12) and (13) on contents-evaluation, the teachers' of both schools said, learning of fractions is an important topic among any other topics in mathematics. Some of the reasons behind this are application to practical life and to deeper mathematics. They mentioned that the main points in teaching "Fraction" are the concept of fraction, numerator and denominator, types of fraction, the relationship of numerical size of numerator & denominator with types of fractions. Again they repeated mostly knowledge and skills aspect. This tendency is in line with the analysis of Bangladesh Curriculum against TIMSS framework of cognitive domains (Mohsin, U., 2005).

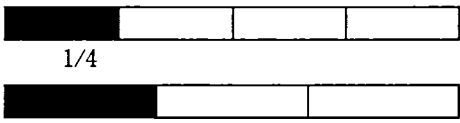
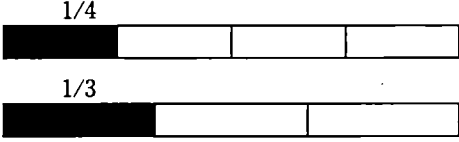
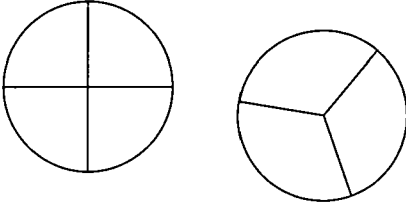
Table 10. Analysis of Bangladesh curriculum against TIMSS framework cognitive domains

TIMSS curriculum assessment cognitive domains (Mullis et al., 2003)		Bangladesh curriculum cognitive domains	
Cognitive domains	Focused area	Cognitive domains	Focused and not focused areas
Knowing facts and procedures	Recall, recognize/identify, compute, use tools.	Knowing facts and procedures	Recognize/identify, compute, use tools are focused but recall is less focused.
Using concepts	Know, classify, represent, formulate, and distinguish.	Using concepts	Know, classify, represent, formulate, distinguish are less focused.
Solving routine problems	Select, model, interpret, apply and verify/check.	Solving routine problems	Select and apply (real life problems) are focused.
			Model, interpret and verify/check are not focused.
Reasoning	Evaluate, generalize, synthesize/integrate, solve non-routine problems, justify/prove.	Reasoning	Evaluate, generalize, synthesize/integrate, solve non-routine problems, justify/prove are not focused.

(e) Teaching-methodology

There were two items (14) and (15) regarding teaching-methodology. As for the item (14) "how to teach, which is longer $1/4m$ or $1/3m$?", teachers said that they would instruct the pupils at first to convert the above two fractions into the fractions with equal denominators and then show the pupils which one is longer, or explain it by using some figures such as meter scale, circle etc. Regarding the item (15) "how to teach, what is a half of $2m$?" They said, they would explain them in class about the idea of half of $2m$ and $1/2m$, or will ask the pupil to take a 2-meter long scale and then instruct the pupil to divide it into two equal parts.

Table 11. Teachers' strategies in fraction

Urban school	Rural school
<p>(14)</p> <p>1. They will instruct the pupils at first to convert the above two fractions into the equal denominator fractions and then will show the pupils which one is longer.</p> <p>2. Will explain it by using the following figures</p> 	<p>1. Will explain it by using the following figures</p>  <p>2. Will explain it by using the following figures</p> 
<p>(15)</p> <p>1. Will explain them about the idea of half of 2m and 1/2m.</p> <p>2. Will explain it by using the meter scale.</p>	<p>1. Will ask the pupil to take a 2-meter long meter scale and then instruct the pupil to divide it into two equal parts. Therefore pupil will be able to understand the correct answer.</p>

4. Conclusion

This research aimed at clarifying the present status of primary mathematics education in Bangladesh from both pupils' and teachers' perspectives. As a result of the field survey the following points were found out.

- As for weak areas for pupils, there is some biased tendency in their responses, and this tendency is not uniform among urban and rural schools although it is not possible to conclude so because of the small sample size. Teachers insisted that the type of question was different from the one which pupils encountered in a usual lesson or test. It is, however, not necessary true if pupils' performance would be better when they solve the usual type of questions. Besides, to promote the innovative thinking it may be necessary to give different types of problems.

- As for linguistic difficulty of pupils, Rahman, S. (1999) and Campaign for Popular Education (2000) also confirmed pupils' weakness in sentence problem. Through interviews it was noted that very few pupils were able to explain the sentence, but some were able to calculate and even to make correct answers. This is a manifestation of rote learning without proper understanding. There is no big difference between urban and rural, and high performer and low performer in this sense. So we can say generally they are weak in conceptual understanding.

- As for teachers' perception about pupils, teaching and textbook questionnaire, there found two very important and indicative points.

(Assessment of pupils' difficulty and understanding level) The first point is that

teachers said they are confident to teach although it is difficult to teach, and it is easy for the pupils to learn. Besides this mismatch, some expected scores by teachers did not reflect actual performances of pupils. This inconsistency is very important for deliberation of the root cause of problem. And it shows that their teaching activity is not fully based on understanding pupils' difficulty.

(Teaching method) They make good efforts to use drawing to explain the concept of fraction. They, however, didn't pay much attention to "understanding the concept", which this research addressed to. With deeper understanding of pupils' difficulty, teaching method should be tailored according to their needs.

From these results, two points can be made as a conclusion. They are namely importance of grasping more precisely pupils' level and status of understanding of mathematical concepts, and of linking teaching activity of mathematical concept with pupils' level of understanding and daily life. Currently in many developing countries they are engaged in quality improvement of education by introducing pupil-centered approach, and Bangladesh is no exception. The approach, however, remains at the level of slogan in many cases, but does not fulfill the substance of this slogan yet.

As for future issues for practical application as well as research agenda, new strategies may be sought in order to shift the slogan to the actual implementation. Especially current curriculum put too much emphasis on knowledge and skills aspects (Table 10), and examination and textbook seem to follow this tendency. Thus, the first issue is to make a thorough analysis on curriculum and textbook from the perspective of pupils' conceptual understanding and linguistic difficulty in it. And the second issue is related to implementation of the ideal into practice. In this end, "Lesson Study" (Stigler et al., 1999) may be implicative in the sense that it involves many teachers to prepare a lesson and improve it as a part of continuous joint process. It is, however, pointed out that education culture may not be easily transplanted. And so problems in implementation and applicability of lesson study are to be carefully examined.

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ANNEX1

Q1. Work out the following calculations.

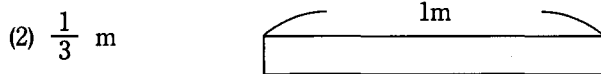
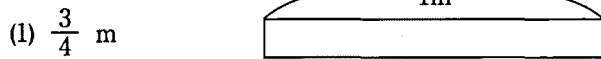
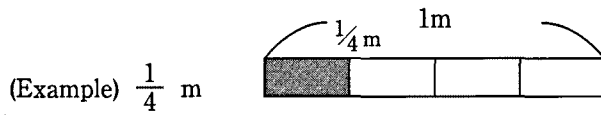
(1) $\frac{1}{5} + \frac{2}{5} =$

(2) $\frac{5}{7} - \frac{2}{7} =$

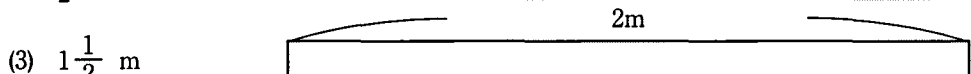
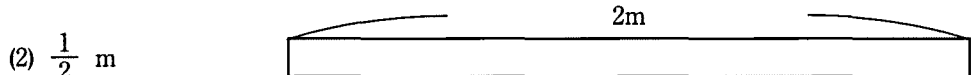
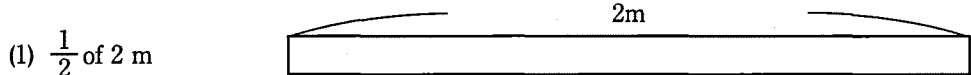
Q2. Express the answer in a fraction.

$3 \div 7 =$

Q3. The following figures show 1m of a bar. Shade a part of the figure to represent the following length.



Q4. The following figures show 2m of a bar. Shade a part of the figure to represent the following length.



Q5. Which of the following is greater than the other? Write a correct choice (1, 2 or 3) in the bracket.

1. A is bigger than B. 2. B is bigger than A. 3. A = B

(1) A: $\frac{2}{5}$ B: $\frac{4}{5}$ Answer: ()

(2) A: $\frac{3}{6}$ B: $\frac{1}{2}$ Answer: ()

(3) A: $\frac{1}{4}$ B: $\frac{1}{3}$ Answer: ()

Q6. Answer the following questions.

(Show your process to get the correct and appropriate answer.)

- (1) When you add $\frac{2}{5}$ ℓ of water to $\frac{1}{5}$ ℓ of water in a container, how much water is in the container?
- (2) When you cut $\frac{2}{7}$ m away from $\frac{5}{7}$ m of a string, what is the remaining length?
- (3) When you arrange 6 pieces of $\frac{1}{6}$ m paper in a line, what is the total length?

Q7. Change the decimal number "0.7" to a fraction.

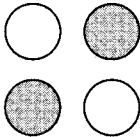
(Show your process to get the answer.)

Q8. Judy bought 5kg of meat. George bought 3kg of meat. Write a fraction in the bracket to show the relationship between Judy's meat and George's meat in terms of weight.

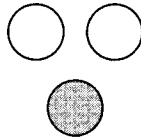
George's meat is () of Judy's meat.

Q9. Which of the following represents "half" *for you*? Circle all the possible choice(s) in which "half" of circle(s) is shaded.

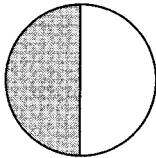
1.



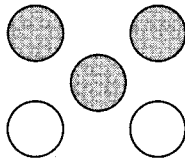
2.



3.



4.



Q10. Imagine and make a sentence problem in which the answer is $\frac{2}{3}$.

(You can express your sentence problem in words and/or any diagrams.)

ANNEX 2

Interview Items for Pupils

Item 1: Inquire what choice they selected and why in Q5 (3).

i) Ask them to read to you the sentence of Q5 (3). Can they correctly read it?

YES NO

ii) If there is any difficult term/expression for them to read, describe it below.

iii) Ask them to explain how they solve the question in words and/or any diagrams.

iv) Describe any specific mistakes, if there are any.

Item 2: Inquire how they solved Q6 (1).

i) Ask them to read to you the sentence of Q6 (1). Can they correctly read it?

YES NO

ii) If there is any difficult term/expression for them to read, describe below.

iii) Ask them to explain how they solved the question in words and/or any diagrams.

iv) Ask them to write their numerical expression to find the answer for Q6 (1).

v) Ask them to calculate the numerical expression. Can they correctly calculate it?

YES NO

vi) Describe any specific mistakes in the calculation, if there are any.

Item 3: Inquire how they solved the Q8.

i) Ask them to read to you the sentence of Q8. Can they correctly read it?

YES NO

ii) If there is any difficult term/expression for them to read, describe it below.

iii) Ask them to explain how they solve the question in words and/or any diagrams.

iv) Describe any specific mistakes, if there are any.

ANNEX 3

Teachers' Questionnaire

Test-evaluation

- (1) What do you perceive to be the average score of pupils on the given test?
(Expected average score in percentages %)
- (2) Are the pupils accustomed to this kind of test? Why do you think so?
1. Yes 2. No
Reason(s):
- (3) Are there some questions which you think the pupils cannot solve? And if yes, what is the reason?
1. Yes 2. No
Question no. and Reason(s):

Self-evaluation

- (4) To what extent do you feel it is easy or difficult to teach "Fractions"? And why do you feel so?
1. very easy 2. easy 3. difficult 4. very difficult
Reason(s):
- (5) What is the most difficult topic for you to teach in Grade 4? And why do you think so?
You can answer more than one topic(s) in this question.
(Topic(s):)
Reason(s):
- (6) What is the easiest topic for you to teach in Grade4? And why do you think so?
You can answer more than one topic in this question.
(Topic(s):)
Reason(s):
- (7) How confident are you when you teach "Fractions"?
1. not confident 2. little confident 3. confident 4. very confident
- (8) How do you think the examinations affect your teaching? Please describe an example how it affects?
1. very much 2. much 3. little 4. very little
Description:

Pupils-evaluation

- (9) How easy or difficult do you think it is for the pupils to learn "Fractions"?
1. very easy 2. easy 3. difficult 4. very difficult
- (10) What is difficult for the pupils to learn the concept of "Fractions"?
Difficulty:
- (11) Do the pupils have any difficulty with the medium of instruction in mathematics learning? And if yes, what is the difficulty?
1. Yes 2. No
Difficulty:

Contents-evaluation

(12) Do you think “Fractions” is an important topic among any other topics? And why do you think so?

1. Yes 2. No

Reason(s):

(13) What is the main point for the pupils when you teach “Fractions”?

Teaching Methodology

(14) Describe how to teach the following question to the pupils?

“Which is longer $\frac{1}{4}m$ or $\frac{1}{3}m$?”

(15) Suppose you posed the following question to the pupils in a lesson.

“What is a half of $2m$?”

Then a student answered, “It is $\frac{1}{2}m$.”

How do you deal with such a student in class?

Author

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