Framework of Research

Acknowledgement

- This project was enabled by the following funds:
- (A) Empirical Study on the Evaluation method for International Cooperation in Mathematics Education in Developing Countries
- (Hideki IWASAKI, International Research funds No. 16402046)
- (B) International Comparative Studies on Influence of teachers' Views about Education on Mathematics Lessons at Primary Schools
- (Takuya Baba, International Research Funds No. 16402045)

Participating Countries

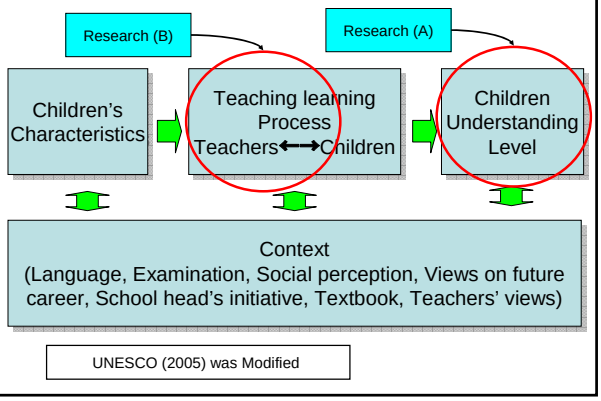
Country	Affiliation	Name
Philippines	University of the Philippines	Dr. Milagros D. Ibe
China	Inner Mongolia Univ. of Education	Prof. Dai Quin
Thailand	Khon Kaen University	Prof. Maitree Inprasitha
Bangladesh	The National Academy for Primary Education	Mr. A.H.M. Mohiuddin
Ghana	University of Cape Coast	Mr. Ernest Davis Kofi
Zambia	University of Zambia	Mr. Bentry Nkhata

Japanese counterparts and Special advisors

Objective

- The ultimate goal is to establish a professional and long-term relationship among the participating countries in the field of mathematics education.
- So, the specific objectives of this project are as follows:
- (1) To compare and analyse the history and curriculum of mathematics education, and the present status of mathematics education such as teachers' views and the learners' achievements in the participating countries. Simple comparisons, however, cannot be made to decide whether one is better than any other country.
- (2) To exchange views and information on the items found in (1). Through this process, alternative models for classroom teaching and assessing children's attained level in mathematics be sought.
- (3) Finally, to establish a professional relationship among researchers in the participating countries, for the endogenous development of mathematics education through this process of knowledge sharing.

Research framework



UNESCO (2005) was Modified

Research Subject and Tools

- One 'average' school in a rural area and one 'average' school in an urban area
- For the teachers, the study will focus on the teachers' views and lesson observation.
- For the children, the study will focus on the test and interviews, in terms of children's cognitive and affective performances.
- First year we conducted survey on all topics, but for the second year, Grade 4, with the topic Fractions, is chosen as the main focus.

YEAR	First year	Second Year
Focus	General	Fraction
Children	Achievement Test Questionnaire	Achievement Test Interview Items (Newmann Procedure)
Teachers	Lesson observation checklists, Interview items	Questionnaire

First Year (Children)

Content Domains	Main Topic	No.
Number	Whole Numbers	18
	Fractions and Decimals	10
	Ratio, Proportion and Percent	1
Patterns, Relations, and Functions	Patterns	4
	Equations and Formulas	4
	Relationships	3
Measurement	Attributes and Units	8
	Tools, Techniques and Formulas	7
Geometry	Lines and Angles	1
	Two- and Three-dimensional Shapes	2
	Congruence and Similarity	1
	Locations and Spatial Relationships	2
	Symmetry and Transformations	4
Data	Data Representation	4
	Data Interpretation	3
		72

Second Year (Children)

Focus of Study

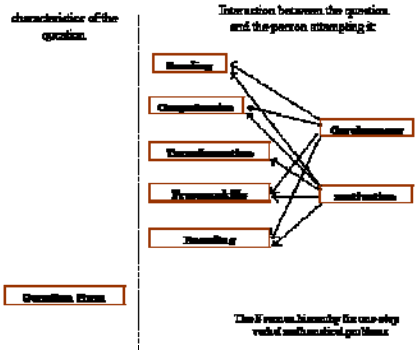
- Grade 4, the topic Fractions, is chosen as the main focus.
- The reasons for this are:
- 1) Grade 4 is perceived as a transitional stage from the concrete operational period to the formal operational period.
- 2) Besides this, countries like Bangladesh have 5 years for primary education and the final year is influenced by other factors such as the scholarship examination.
- 3) 'Fractions' is perceived as the first topic in abstract mathematics, it is a common topic for all the countries, and is from the dominant number domain.

Additional Method

- (a) Neither of reading in mother tongue nor additional explanation of how to express the answer (Standard method)
- (b) Reading of test item in mother tongue, but no additional explanation of how to express the answer (Alternative method I)
- (c) Both Reading of test item in mother tongue and additional explanation of how to express the answer. (Alternative method II)

Second Year (Children)

Newman Procedure



First and Second Year (Teachers)

First Year

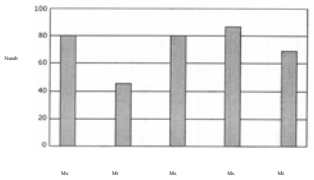
- **Lesson Observation Checklist**
- The lesson observation checklist aimed to describe each lesson quantitatively and qualitatively, and especially focused on the structure and flow of lesson and the relationship between teachers and pupils.
- **Interview Items**
- The interview items for teachers focused on their cognition about problem in teaching mathematics, the lesson observed, and in-service training.

Second Year

- **Questionnaire**
- The Questionnaire focused on the teachers' evaluation of test, oneself, pupils, contents, teaching methodology. As for some questions about "pupils" in the questionnaire, let teachers answer about their own pupils, not pupils in their country as a whole.

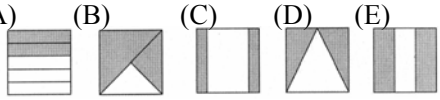
1st Year Research Tools

[1-1]Central School had a bottle collection. Children in each class brought empty bottles to school. The principal made a bar graph of the number of bottles from five classes. Which class collected 45 bottles?
(A)Miss Barber's class (B)Mr. Chyn's class (C)Mrs. Friedman's class (D)Mr. Mack's class



[1-2]Jasmine made a stack of cubes of the same size. The stack had 5 layers and each layer had 10 cubes. What is the volume of the stack? (A)5 cubes (B)15 cubes (C)30 cubes (D)50 cubes

[1-3]Which shows 2/3 of the square shaded? (A) (B) (C) (D) (E)



[1-4]It takes Chris 4 minutes to wash a window. He wants to know how many minutes it will take him to wash 8 windows at this rate. He should (A)multiply 4×8 (B)divide 8 by 4 (C)subtract 4 from 8 (D)add 8 and 4

[1-5]Here is a calendar for December.
Mary's birthday is on Thursday, December 2. She is going on a trip exactly 3 weeks later. On what date will she go on the trip?
(A)December 16th (B)December 21st (C)December 23rd (D)December 30th

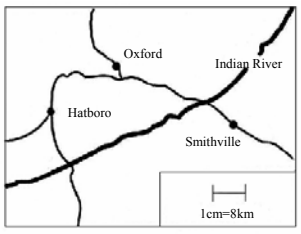
DECEMBER						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

[1-6]Which digit is in the hundreds place in 2345? (A)2 (B)3 (C)4 (D)5

[1-7]Which number would be rounded to 600 when rounded to the nearest hundred?
(A)62 (B)160 (C)546 (D)586 (E)660

[1-8]Which of these means $\frac{7}{10}$? (A)70 (B)7 (C)0.7 (D)0.07

[1-9]One centimeter on the map represents 8 kilometers on the land. About how far apart are Oxford and Smithville on the land?
(A)4 km (B)16 km (C)35 km (D)50 km



[1-10]Which of these could be the weight (mass) of an adult? (A)1 kg (B)6 kg (C)60 kg (D)600 kg

[1-11]Which of these is a name for 9740?

(A)Nine thousand seventy-four (B)Nine thousand seven hundred forty

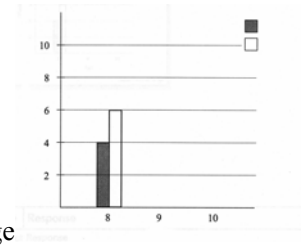
(C)Nine thousand seventy-four hundred (D)Nine hundred seventy-four thousand

[1-12] □ represents the number of magazines that Lina reads each week. Which of these represents the total number of magazines that Lina reads in 6 weeks?

(A) 6＋ □ (B) 6× □ (C) □ ＋6 (D) (□ ＋ □)×6

[2-1]This table shows the ages of the girls and boys in a club.

Age	Number of Girls	Number of Boys
8	4	6
9	8	4
10	6	10



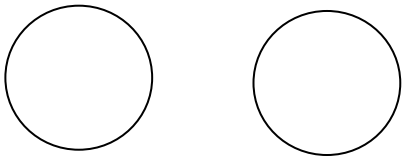
Use the information in the table to complete the graph for age

[2-2]Sam said that $\frac{1}{3}$ of a pie is less than $\frac{1}{4}$ of the same pie. Is Sam correct? .....

Use the circles below to show why this is so.

Shade in $\frac{1}{3}$ of this circle

Shade in $\frac{1}{4}$ of this circle



[2-3]These shapes are arranged in a pattern. ○△○○△△○○○△△△

Which set of shape is arranged in the same pattern?

(A) ★□★□★★□□★★□□ (B) □★□□★□□□★□□□□

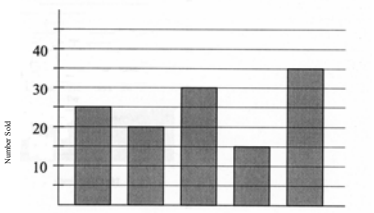
(C) ★□★★ □□★★★□□□ (D) □□★★□★□□★★□★

[2-4]There are 600 balls in a box, and $\frac{1}{3}$ of the balls are red. How many red balls are in the box?

Answer：.....

[2-5]The graph shows the number of cartons of milk sold each day of a week at a school. How many cartons of milk did the school sell on Monday? Answer：.....

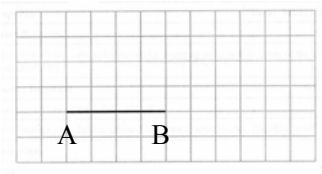
How many cartons of milk did the school sell that week? Show your work. Answer：.....



[2-6]Which of these could equal 150 milliliters? (A)The amount of water in a cup

(B)The length of a kitten (C)The weight of an egg (D)The area of a coin

[2-7]Lia is practicing addition and subtraction problems. What number should Lia add to 142 to get 369? Answer：.....

[2-8] 

Draw a triangle in the grid so that the line AB is the base of the triangle and the two new sides are the same length as each other.

[2-9]Mr. Brown goes for a walk and returns to where he started at 07:00. If his walk took 1 hour and 30 minutes, at what time did he start his walk? Answer：.....

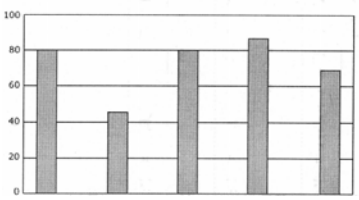
[2-10]The graph shows 500 cedar trees and 150 hemlock trees.

Cedar	
Hemlock	

How many trees does each  represent? Answer：.....

[3-1]Central School had a bottle collection. Children in each class brought empty bottles to school. The principal made a bar graph of the number of bottles from five classes. Which class collected 45 bottles?

(A) Miss Barber's and Mrs. Friedman's classes
(B) Miss Barber's and Mr. Mack's classes
(C) Mrs. Friedman's and Miss Gonzalez's classes
(D) Miss Gonzalez's and Mr. Mack's classes



[3-2]When Tracy left for school, the temperature was minus 3 degrees  At recess, the temperature was 5 degrees. 

How many degrees did the temperature rise? (A)2 degrees (B)3 degrees (C)5 degrees (D)8 degrees

[3-3]Figures that are the same size and shape are called congruent figures.

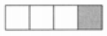
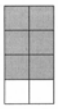
Which two figures are congruent? (A)1 and 2 (B)1 and 3 (C)1 and 4 (D)3 and 4

[3-4]

Suject: $\begin{array}{r} 4.03 \\ -1.15 \\ \hline \end{array}$ (A)5.18 (B)4.45 (C)3.12 (D)2.98 (E)2.88

[3-5]In this diagram, 2 out of every 3 squares are shaded.

Which diagram has 3 out of every 4 squares shaded?

(A)  (B)  (C)  (D) 

[3-6]This chart shows temperature reading made at different times on four days.

TEMPERATURE					
	6 a.m.	9 a.m.	Noon	3 p.m.	8 p.m.
Monday	15°	17°	20°	21°	19°
Tuesday	15°	15°	15°	10°	9°
Wednesday	8°	10°	14°	13°	15°
Thursday	8°	11°	14°	17°	20°

What was the highest temperature recorded?

(A)Noon on Monday

(B)3 p.m. on Monday

(C)Noon on Tuesday

(D)3 p.m. on Wednesday

[3-7]Janis, Maija, and their mother were eating a cake. Janis ate $\frac{1}{2}$ of the cake. Maija ate $\frac{1}{4}$ of the cake. Their mother ate $\frac{1}{4}$ of the cake. How much of the cake is left?

(A) $\frac{3}{4}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) None

[3-8]What number equals 3 ones＋5 tens＋4 hundreds＋60 thousands?

(A)6 453 (B)60 453 (C)64 530 (D)354 060 (E)604 530

[3-9]What units would be best to use to measure the weight (mass) of an egg?

(A)centimeters (B)milliliters (C)grams (D)kilograms

[3-10]All of the pupils in a class cut out paper shapes. The teacher picked one out and said, “This shape is a triangle.” Which of these statements MUST be correct?

(A)The shape has three sides. (B)The shape has a right angle.

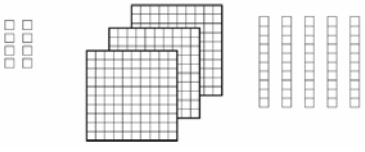
(C)The shape has equal sides. (D)The shape has equal angles.

[3-11]There are 9 boxes of pencils. Each box has 125 pencils. What is the total number of pencils?

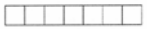
(A)1025 (B)1100 (C)1125 (D)1220 (E) 1225

[3-12]Each small square (□) is equal to 1. There are 10 small squares in each strip. There are 100 small squares in each large square.

What number is shown? (A)16 (B)358 (C)538 (D)835



[3-13]Which of these figures has the largest area?

(A)  (B)  (C)  (D) 

Interview Items for Mathematics Teachers

Please answer freely the following items. In case you need some clarification, you can ask interviewer any time.

[Problem]

1-1) What do you think is the biggest problem in teaching mathematics in you class?

1-2) What kind of action do you take against that problem?

[Today's lesson]

2-1) What was the purpose of today's lesson?

2-2) How much do you think the purpose was attained?

2-3) What do you think are the most important factors for successful lesson?

2-4) What kind of teaching would you like to do?

[In-service training]

3-1) Have you ever had a teacher training after you become a teacher?

3-2) Which kind of training, if you had before, do you think is useful for your teaching?

3-3) What kind of training do you think is necessary for improvement of your lesson, if a new training course is designed?

Interview Items for Head-Teachers

Please answer freely the following items. In case you need clarification you can ask interviewer any time.

[Problem]

1-1) What do you think is the biggest problem in teaching mathematics in your school?

1-2) What kind of action do you take against that problem as an administrator?

1-3) Do you observe lessons by teachers? YES or NO

If YES, how often do you observe them?

1-4) What kind of advice do you give to young teachers at your school?

[In-service training]

2-1) Do you see any impact of in-service course offered to teachers? If yes, is it negative or positive? Please describe the impact a little more.

2-2) What kind of training do you think is necessary for teachers in your school, if a new training course is designed?

Lesson Observation Checklist

NAME of Observer: SCHOOL GRADE: 4 DATE;

SUBJECT Mathematics TOPIC Fraction No. of PUPILS: MALE FEMALE

During the lesson, please take a record of the lesson in the video, and after the lesson, indicate your assessment of the following aspects of the lesson by placing a tick in the appropriate box on the rating scale. (Rating scale: 0 – never, 1 –seldom/ to a little extent, 2 – sometimes/ to some extent, 3 – often/ to a considerable extent, 4 - very often/ to a great extent)

		0	1	2	3	4
Introduction	The teacher starts the class on time.					
	The teacher made the objective clear.					
	The objective suits to the level of children.					
	Relationship with the previous lesson is clear.					
Development	The teacher gives supports to pupils who seem to have little understanding.					
	The teacher expresses appreciation for pupils' thinking attitudes.					
	The teacher assesses the pupils' comprehension during teaching learning.					
	The teacher uses easy language.					
	The teacher uses an appropriate and familiar example to illustrate main concept.					
	The teacher creates friendly atmosphere.					
	The teacher accommodates discussion among pupils.					
	The teacher gives hands-on activity.					
	The teacher enjoys teaching.					
	The teacher is impatient with wrong answer.					
	The teacher involves children to say opinions freely.					
	The teacher encourages children to display diverse opinions.					
	The children are actively engaged in learning, such as telling opinions, asking questions, solving problems etc.					
	The teacher combines individual work and group work appropriately.					
Summary	At the end of the lesson, the teacher summarizes the lesson.					
	The teacher assigns home work at the end of lesson clearly.					
	The teacher explains about a connection between today's lesson and next lesson.					
General	The teacher prepares a lesson plan.					
	The teacher prepares a plan for taking note on the blackboard.					
Describe objective of today' lesson.						
Describe problems/ activities. (No. of problems, relation among them, their difficulty level etc.)						
Describe children's opinions						
Assess who dominate solving problems during the lesson observed.						
Assess which of the followings is regarded as the most important in the lesson observed. Understanding concept/ mastering the procedure/ thinking mathematically/ applying to the daily life/ finding correct answer						

2nd Year Research Tools

Q1. Work out the following calculations.

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

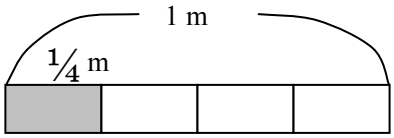
(2) $\frac{5}{7} - \frac{2}{7} =$

Q2. Express the answer in a fraction.

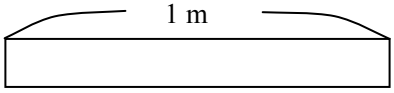
$3 \div 7 =$

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

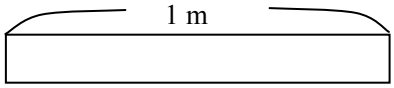
(Example) $\frac{1}{4}$ m



(1) $\frac{3}{4}$ m

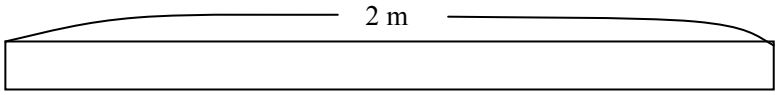


(2) $\frac{1}{3}$ m

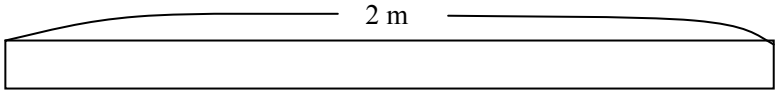


Q4. The following figures show 2m of a bar. Shade a part of the figure to represent the following length.

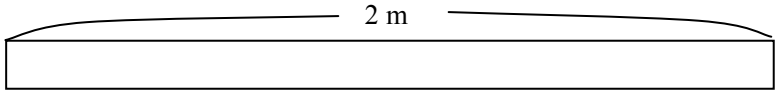
(1) $\frac{1}{2}$ of 2 m



(2) $\frac{1}{2}$ m



(3) $1\frac{1}{2}$ m



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 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.

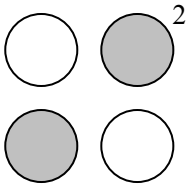
(Show your process to get the answer.)

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.



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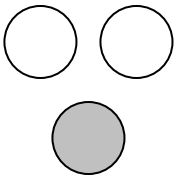

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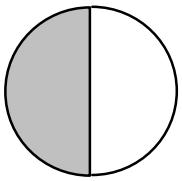

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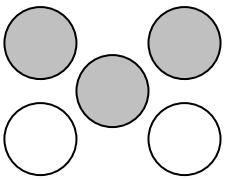

Q10. Imagine and make a sentence problem in which the answer is $\frac{2}{3}$.

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

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.

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 1/4m or 1/3m?"

(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 1/2m."

How do you deal with such a student in class?