

IMPROVING TEACHING MATHEMATICS OF PRIMARY SCHOOL IN EGYPT

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This article summarized the JICA project for improving teaching mathematics in primary school in Egypt from the beginning of April 2003 to the end of March 2006. This long-term study depends on centered students-study approaches focus on problem solving as a teaching method to develop students' achievement and attitude. The main process of this project centralized on improve performance of teacher and its activities in mathematical class, in specific of using problem solving as teaching method to be skilled in its process. By our observation of students and analysis of achievement test during this project the mathematical class was improved, for example: students' oral and writing communication, representation, solving daily life problems, discussing mathematical thinking and assessment.

Theoretical framework

By the beginning of the twentieth century, several important developments had taken place in the world of the mathematics. New branches of the subject had been developed, and more refined and powerful problem-solving techniques had gradually replaced established standard methods of working. Many traditional areas of mathematics had been re-conceptualized in an attempt to put the subject on a firm logical foundation

Now Mathematics instructional programs should focus on solving problems as part of understanding mathematics so that all students: build new mathematical knowledge through their work with problem, develop a disposition to formulate, represent, abstract, and generalize in situations within and outside mathematics, apply a wide variety of strategies to solve problems and adapt the strategies New Situations, monitor and reflect on their mathematical thinking in solving problems.

Problem solving is an integral part of mathematics learning. Students should regularly work on tasks where the solution path is not readily apparent and where solving the problem requires more than just merely applying a familiar procedure. Solving problem is not only a goal of learning mathematics but also a major means of doing so. Students should have frequent opportunities to formulate, grapple with, and solve complex problems that require a significant amount of effort and should then be encouraged to reflect on their thinking (NCTM, 2000,49). As students think about new problems, they not only learn how to solve similar ones, they can also develop new skills and ideas.

Mathematics Education in Egypt

In Egypt, mathematics is a core subject. Through visiting school and observation , teacher in action, the style of mathematics education was described as explanation style: in mathematics class teacher depends on presenting one or more example of concepts , and write the rules, generalizations, characters related to this concepts, then he gives students time to solve more practices individually to evaluate them, finally he make conclusion in blackboard. Maybe he uses some concrete materials to explain when teacher teach skills. You can say teacher works and talks more than students.

In general teacher thinks solving more practices is important to understand, but in this case the students use some rules, operations and procedures to get right solutions. Also about solve daily life problem, teacher depends on textbook to select problems, but most of these problems aren't logical with daily life problems. Teacher needs to know how to posing problem or making word problem. One point related to solving problems is process not right answer. Process is very important. It gives students chance to express to their ideas. It includes mathematical thinking process. Also teacher should know how to make expectations of students answer, and how to use the wrong answer.

Why the JICA Project

JICA project is very important for students, teachers and schools. For example it helps the NCERD staff (fifteen Researchers) to give proper instruction to teachers on the new teaching methods in Egypt, that is, the child-centered and problem solving methods including lesson plan. Then the teachers at the selected schools mastered the new teaching methods and practiced them in class, and the methods were proved to be effective. In general it helped teacher to change his teaching method from only explanation to child-centered study, so students' academic performance effected on their understanding, attitude and interest in mathematics.

Principles of project (protocol)

- 1- depending on cooperation between JICA, Hokkaido Univ. of education staff and NCERD staff, Hokkaido Univ. of education staff present experiences of mathematics education through long time experts and short time experts, they present their experiences about teaching methods, teacher training courses, and evaluation. Also visiting NCERD staff Japan to take training course in action in Hokkaido Univ. of Education and visiting primary schools.
- 2- depending on child-centered study including problem solving as teaching method.
- 3- Review the guidebooks of teaching mathematics

4- the new teaching methods are interdicted in existing teachers training courses, then recognized by the people in education field.

Methodology, Design and Procedures

Eight experimental schools were selected in this project, four of them as a pilot school, and four of them as control schools. In this project there are two targets we deal with them (teachers is first target and direct operation, students are the second target and indirect operation,).It is long Term - Study, the same students from Fourth grade to Sixth grade, also it depends on pre _ post Test and Questioner

Target	A pilot School	Control school	Variables
Teacher	7	7	Teaching Strategy
Students	About35 each class		Achievement &Attitude

Table1:Targets of project

This project depends on the good technique to support the teachers using child centered- study. There are a lot of activities that were done, For example: **Visiting school, In-service training courses, Open class**

Visiting school: In the pilot school, teachers required background about the project mathematics education, guide book (GB), child centered-study and problem and problem solving as teaching methods. The members of this project (JICA member and NCERD)have visited each school weekly. They used to observe the teacher in mathematics class to see how the teacher teach, how the teacher encourage students to depend on the previous experience to deduce new concepts, also how the students develop the ideas, working in group or individually. In general, they have observed how the teacher prepared the teaching plan and follow it to achieve the aims of lesson.

After the end of class (one hour), the member has made a meeting with mathematics teachers to discuss good point in class and how to improve their performance in teaching mathematics. This open discussion as part of strategy was very important for teachers. They learn what the differences among ways depending on explanation and other ways depending on child centered- study. The member of project have observed improving performance of mathematics teacher in pilot school gradually most of them use problem solving as teaching method well. They depend on concreted mathematics instead of symbolic mathematics.

In-service training courses: The members of project have thought of providing mathematical teachers in another experimental school background about this project and good practice lesson. The technique of this training course have tacked care of

presenting framework of teaching mathematics including how to deal with the unit in test book depending on guide book (what to teach, why to teach how to teach), also process of problem solving as teaching method, then presenting good practice using micro teaching, finally open discussion to develop precipitant' ideas all this paint was in the first day, in the second day teachers have presented good practices depending on strategy. Through discussion, the idea of teachers have improved and their believes have been changed. In the third day teachers observe open class in pilot school and discuss it to require more experiences and skills.

CONTANT OF TRAINING COURSES

Using Guide Book:

In this point, teachers are presented what the philosophy of the GB and how they can use it. It is very essential the teachers recognize dealing with units and subject in Egyptian Mathematics Textbooks through presenting an example like this:

Unit 2 Proportion and its application

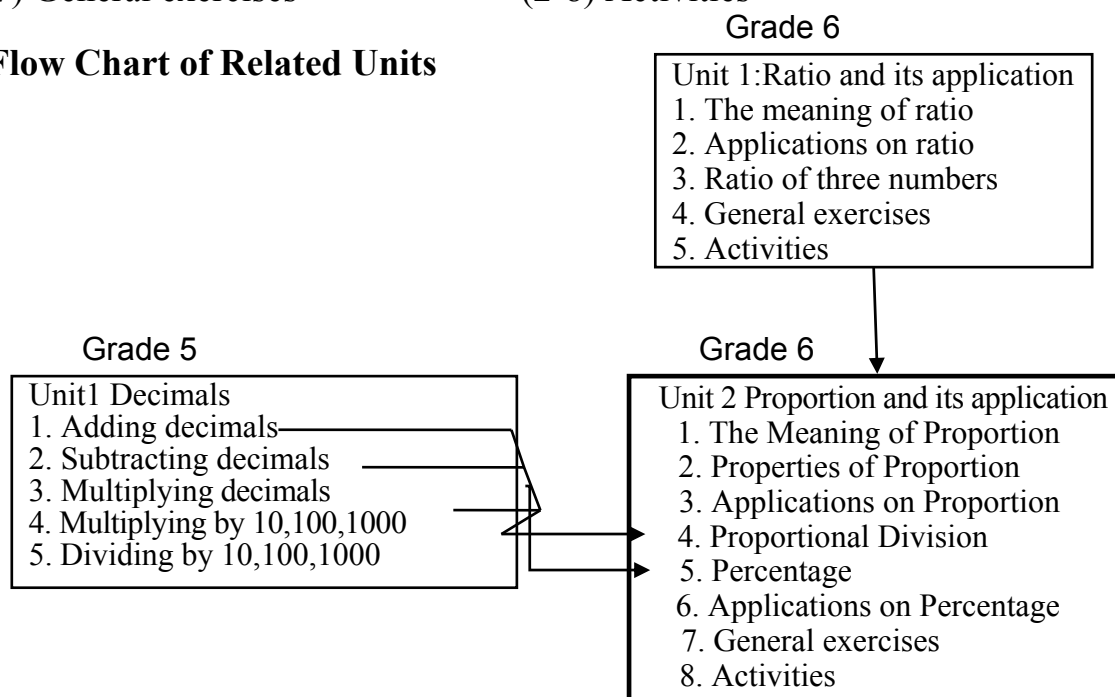
A. Aims of the Unit, **1. Aims of the Instruction**, The students should be able to:

(1-1) calculate the second, third, or forth proportion in a proportion involving four numbers. (1-2) use the property of product of extremes = product of means. (1-3) express missing term in a proportion by a symbol, and then calculate its value using more than one property in the proportion.

2. Lessons

- | | |
|---------------------------------|--------------------------------------|
| (2-1) The meaning of proportion | (2-2) Properties of proportion |
| (2-3) Application on proportion | (2-4) Proportional division |
| (2-5) Percentage | (2-6) Applications using percentages |
| (2-7) General exercises | (2-8) Activities |

3. Flow Chart of Related Units



B. Brief Explanation of the Contents

1. *What to Teach*

Proportion is a concept applicable for quite various uses. For example:

(1-1) The weight of a nail can be calculated by weighing 100 nails and dividing the value by 100. The number of nails is proportional to the total weight of the nails .

(1-2) The distance that a car drove at 60 km/h can be calculated if the driving time is given. The driving time at a fixed speed is proportional to the distance covered.

(1-3) A spring balance is an application of the proportion of the weight of a subject to the extension of the spring. The samples above indicate the following features of proportion.

Proportion is a quantitative correlation.

Sample 1) is a correlation of the number of nails and the total weight of the nails.

Sample 2) is a correlation of the driving time and the distance covered.

Sample 3) is a correlation of the weight of a subject and the extension of the spring.

The proportional ratio is fixed.

In the case of sample 1), the quotient of the “total weight of nails” divided by the “number of nails” is always the numerical value of the “weight of a nail.” In the case of sample 2), the quotient of the “distance covered” divided by the “driving time” is always the “driving speed.” In the case of sample 3), the quotient of the “weight of a subject” divided by the “extension of the spring” is always the “spring constant.”

One of the proportional changes twofold/threefold, the other also doubles/triples.

There are two approaches necessary to learn for the application of proportion as follows: Approach to verify if the two values concerned are proportional, Another Approach to solve a problem based on the proportional correlation between the values concerned. Both approaches are based on the features of proportion. To verify if the two values concerned are proportional, it is necessary to measure the values in more than one case as reference data. For example: The following table deals with the data on the length of a burning candle. The elapsed time from lighting and the length of the candle that has been burned at the point of time are measured.

Time (minute)	5	10	15
Burned length (mm)	3	6	9

The correlation between the elapsed time and the burned length is regarded to be proportional, as the ratio is fixed. Therefore, it is possible to predict how much the candle will be burned down in one hour after it is lit. It can be calculated from by how much shorter the candle was three minutes after the lighting.

The burned length of the candle is 3mm after five minutes from the lighting. Based on the constant of the proportionality, the burned length after three minutes from lighting can be calculated at 1.8mm, by the expression $3 \times 3 \div 5$. (Refer the following table.)

Time (minute)	3	5
Wore length (mm)	?	3

2. Why to Teach

The contents of this unit are essential from the following viewpoints:

Most of the previous studies on number and calculation can be utilized for understanding proportion. The concept of proportion, similar to that of ratio, is essential not only in our daily life but also for scientific studies.

3. How to Teach

(3-1) Methods for Achieving the Aims

As shown by the examples with nails and candles, proportion is a correlation of concurrently changing volumes, e.g. the number of nails and the total weight of the nails, or the burning time of a candle and the decrease in length. It is necessary to know if a correlation is proportional, or what a proportional relation indicates. Pupils need to work on these examinations before learning how to process proportion with calculation.

In our daily life, there are some situations by which pupils can make sense of the importance of proportion: for example, the sense of ingredient proportion is necessary for cooking. The teacher should try to give such situations for pupils to easily understand proportion.

(3-2) Planning Classes: In this case, the timetable is distributed. Teacher understands number of lessons, hours, and determines aims of each lesson.

C. Examples of Instruction Scenarios

The GB present example to explain how the teacher shows the problem, give students chance to read it and discuss, then make expected answer, also how the students think, work: grouping, individual, whole class. Finally, students should make communication to present their ideas to solve the problem.(see index1: teaching plan for a good practice)

One important point included in content course is Teaching Process in Problem-Solving-Study. It includes this process: Teacher shows the problem of this lesson to students, Students ask the teacher some questions about the problem and discuss with each other. They take notes, then Teacher shows the theme of this lesson to students, and Students think of how to solve the problem individually or in groups, after that teacher helps the class to learn during a student's presentation, Teacher puts to

several students' thoughts, now students can understand how to solve the problem; finally teacher evaluates students' understanding of the aim and contents of lesson.

Result & Discussion

Through working with the teachers & students there are improvement in performance teachers & students and attitudes as following:

Teachers in pilot schools use problem solving as a teaching method, depending on process of teaching. They give students chance to deduce new concept and build their mathematical knowledge (conceptual knowledge, procedural knowledge, problem solving). They encourage students to use previous experiences to expect answers. Teacher works as facilitator for students to think and work themselves.

On the other hand, teacher could deal with textbook including organize information, select the suitable problems and modify them for lessons, transform the problem to daily life problem, and connect between mathematical concepts and skills, also, determine the process that is necessary as simulation for students.

Students in pilot school communicate to discuss problem, and express their thought in oral and communication. They can explain the process and operation of solving and give different way to solve problem. Also they learn new concepts and skills when they work. This strategy gives students chance to discover the value of mathematics, they make connections among mathematics through daily life problem and applications. The students now make word problems to show how they have understood clear and give examples from life expressing mathematical expression. Now, this strategy makes students have good thought, high achievement and positive attitude.

Challenges & difficulties

In general changes; mathematical teacher believes about nature of mathematics as a subject and mathematics education is very essential: mathematics is not symbolic language or group of operation the students have performed them. Mathematics is a language that all people speak, and is ways of thinking that students should learn. Also mathematics education isn't only explaining and presenting concepts, it is field helping teacher to recognize (what, why, how) to teach. The second point should be reformed is mathematical textbook. It includes more example and practice to present concepts and skills, but there is no process that students must do it to deduce and understand these concepts and skills.

About the problem solving as a teaching methods, the teachers need more experience about how to present problem and give students time to read, analysis, remember previous experiences related before thinking to expect and solve. Also they must finish teaching plan on time.

References

Ministry of Education (2004): Mathematics Textbook for Sixth Grades, *Book Section*, Egypt.

National Council of Teachers of Mathematics (2000): Principles and Standards for School Mathematics. Reston .Va: *National Council of Teachers of Mathematics*.

Index (1) Teaching Plan

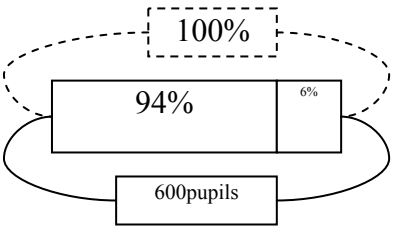
Lesson: Applications on percentage (6th grade 1st Term Unit2)

Aims of this lesson: By the end of this lesson students will be able to

- 1- solve daily life problems related to proportion
- 2- think how to solve in many ways, those are, by using figures, formulas and the meanings of percentages, etc.
- 3- know the meaning of the formula by using figure.

Development of this lesson

	Teacher's Activity	Students' Activity	Remark
OPENING	<p>T: We have studied the meaning of percentage and converting of percentage to fraction and vice versa. (Teacher asks students to read the problem.)</p>	<p>Students read the problem They think about... EX. *the meaning of the sentence. *the meaning of %. *the meaning of 6% etc. * mathematical exertions</p>	<p>Teacher asks students to think themselves</p>
	<p>Problem (1) In a primary school there are 600 pupils. One day 6% of the total were absent. Find the number of the pupils who were absent on that day.</p>		

<p>Development</p>	<p>Teacher presents this problem and gives handouts to each student. Teacher makes students solve the problem and explain their ideas.</p> <p>Teacher asks students discuss which solution is useful. Teacher gives students a similar exercise .</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Problem(2) Your father bought a T.V set with a discount of 15% if its listed price was L.E1280, find the money your father paid after the discount</p> </div>	<p>Students think how to solve by each group. (Expected answers)</p> <p>* Absent; $600 \times 6\% = 36$</p> <p>*</p> <table border="1" style="margin-bottom: 10px;"> <tr><td></td><td>Absent</td><td>Total</td></tr> <tr><td>Value</td><td>.....</td><td>600</td></tr> <tr><td>Per %</td><td>6</td><td>6</td></tr> </table> <p style="text-align: center;">$Absent = \frac{600 \times 6}{100} = 36$</p> <table border="1" style="margin-bottom: 10px;"> <tr><td></td><td>Absent</td><td>present</td><td>Total</td></tr> <tr><td>Value</td><td>.....</td><td>.....</td><td>600</td></tr> <tr><td>Per</td><td>6</td><td>94</td><td>100</td></tr> </table> <p style="text-align: center;">$Absent = \frac{600 \times 6}{100} = 36$</p> <p style="text-align: center;">*</p>  <p style="text-align: center;">Value of 1% = $600 \div 100 = 6$ Absent = $6 \times 6 = 36$</p> <p style="text-align: center;">$6\% = \frac{6}{100}$</p> <p style="text-align: center;">Absent = $600 \times \frac{6}{100} = 36$</p> <p>Students present their ideas.</p>		Absent	Total	Value	600	Per %	6	6		Absent	present	Total	Value	600	Per	6	94	100	<p>(Students solve this problem in group.) Teacher walks among desks to support each group. It is convenient to use the figure for understanding the meaning.</p> <p>Students solve it individually.</p>
	Absent	Total																						
Value	600																						
Per %	6	6																						
	Absent	present	Total																					
Value	600																					
Per	6	94	100																					
<p>Closing</p>	<p>Teacher rounds off today's class with review. Teacher gives homework.</p>	<p>Today we learnt how to solve the life problem in many ways.</p>																						