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DEVELOPING PRIMARY STUDENT'S THINKING COMPETENCE THROUGH TEACHING MATHEMATIC SOLVING

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Abstract

Math is a subject that has a lot of potential teachers can explore to develop students' thinking competence. Based on the research of psychologists and educators in Vietnam and abroad about the organization of teaching in the direction of activating cognitive activities of learners, in this article we propose the application of teaching based on the operational point of view, to teach mathematics in elementary school to develop the thinking ability of students (ones with increasing complexity, ones that can be solved in many ways, exploiting and transforming the problem in different directions, etc.). Through these activities, teachers will foster and develop primary students' thinking competence.

Keywords: *Mathematical solving, thinking competence, primary students.*

1. Introduction

General education in our country is now changing strongly from (mainly) teaching to equip students with the knowledge to teaching in the direction of forming and developing learners' capacity. Training and developing learners' capacity is an important task in teaching in schools.

Pursuant to the general education program (2018), thinking ability is one of the basic competencies that need to be developed for students in general and primary school students in particular [1, 2]. In Mathematics, thinking capacity is also one of the core components of mathematical competence [1, 2]. Some education experts have researched on teaching, teaching on capacity development [3-7]; a number of research articles on the organization of teaching mathematics in primary schools are in the direction of developing learners' capacity, training thinking ability for primary school students [10-12]. Some articles suggest the direction of Training and developing thinking for students through specific teaching situations (teaching math concepts in primary schools) [13] or propose solutions to develop different types of thinking skills. specific thinking force for primary school students [14, 15],...

It can be seen that the problem of developing thinking capacity for students in teaching Mathematics has been studied by

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many people. In this article, we propose a direction to organize math-solving teaching to not only help students solve problems, but also towards knowing how to find solutions; solve problems in different ways as well as exploit problems in many directions, and look at the problem from many angles to promote the development of thinking ability for students.

2. Methods

To carry out this research, we use the theoretical research method to research competencies and teach capacity development and thinking development for primary school students, from which to study the direction of application in practice through examples of specific problems.

3. Results and discussion

3.1. Capacity and thinking capacity

According to the General Education Program (overall program) [1], capacity is a combination of available qualities and the learner's learning and training process; is the general mobilization of knowledge, skills and other personal attributes (such as interest, belief, will,...) and capacity formed and developed through activities and expressed in successfully perform a certain type of activity, achieving the desired result under specific conditions.

According to the General Education Program in Mathematics [2], one of the goals of the Math program is to form and develop students' mathematical competence. Mathematical competence with the core components being: mathematical thinking and reasoning ability, mathematical modeling ability, mathematical problem-solving ability, mathematical communication capacity, and the ability to use math tools and methods. As for the thinking ability of primary school students in learning Mathematics, the most specific manifestation is that they can perform thinking operations (at a simple level), especially observing, look for similarities and differences in familiar situations and confirm the results of observations.

In the following presentation, we would like to propose some measures to develop students' thinking ability in the process of teaching math problem solving in primary schools.

3.2. Methods of solving math problems in elementary school

According to Nguyen Ba Kim [5], based on general ideas along with detailed suggestions of Polya [8] on how to solve problems that have been tested in teaching practice, the general process to solve a problem in four steps can be outlined as follows:

Step 1. Find out the content of the topic

Step 2. Find a solution

Step 3. Present the solution

Step 4. Deeply study the solution

The 4-step method of solving math problems as above is the general suggestion, as a basis for teachers to guide students to perform in solving math problems. At the primary level, these steps need to be specifically guided by teachers and illustrated with examples so that they can understand and perform.

In this part, we do not go deep into the analysis of the 4 steps of the problem-solving process, but focus on exploiting 2 orientations to develop thinking ability for primary school students, that is, for students

to solve problems. increasing in complexity, exploiting the problem to find solutions as well as expanding the problem.

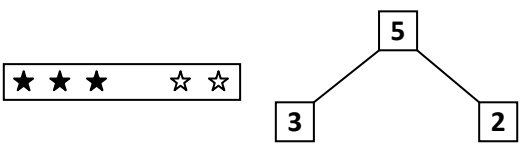
3.3. Some suggestions to develop thinking ability for primary school students through teaching and solving math problems

a) Train students to familiarize themselves with and solve problems of increasing complexity

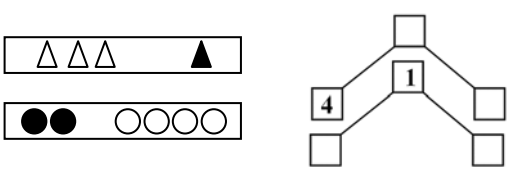
In teaching math, teachers help students familiarize themselves with and solve problems of increasing complexity to gradually contribute to the development of their thinking. Here are some illustrative examples.

Example 1: Fill in the correct number?

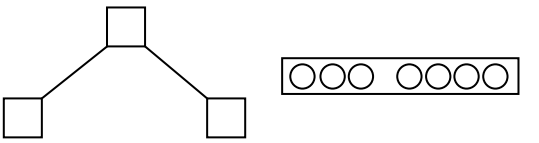
Given a picture with stars and the following flowchart, ask students to observe and comment on the relationships between the stars and the numbers in the flowchart:



Then, the teacher asks students to look at the figure (on the left) and fill in the information (fill in the numbers) in the flowchart on the right of the pictures below:



Next, the teacher asks students to observe the following diagram:



Then ask the children to color in the circles in the picture on the right. This job helps students practice analytical thinking, comparing, synthesizing, similar,... with increasing requirements in terms of complexity and difficulty of the problem.

Example 2. Sum

$$S = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{64}$$

This problem has many different solutions. It is possible to reduce the denominator and perform the addition of fractions, etc. or the teacher can suggest to the students that, when increasing each term of S by 64 times, the adding fractions becomes adding natural numbers, which is easier to do:

$$S = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{64}$$

$$64S = 32 + 16 + 8 + 4 + 2 + 1 = 63$$

Thus, $S = \frac{63}{64}$.

In essence, this is just another way of writing the denominator method.

If the teacher guides and prompts students to see the signs: In the sequence of fractions above, the preceding fraction is twice as large as the second, if each term in the sum is doubled, it becomes a term right before it (except for the first term), we have one more way to calculate the sum S, specifically as follows:

$$S = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{64}$$

$$2S = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{32} = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{32} + \frac{1}{64} - \frac{1}{64}$$

Hence, $S = 1 - \frac{1}{64} = \frac{63}{64}$

Continuing to exploit the terms of the sum, we see that:

$$\frac{1}{2} = 1 - \frac{1}{2}$$

$$\frac{1}{4} = \frac{1}{2} - \frac{1}{4}$$

So: $$S = 1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{4} + \frac{1}{4} - \frac{1}{8} + \frac{1}{8} - \frac{1}{16} + \frac{1}{16} - \frac{1}{32} + \frac{1}{32} - \frac{1}{64}$$

$$S = 1 - \frac{1}{64}$$

Thus, $S = \frac{63}{64}$

Through this problem, it can be seen that, by equating the denominators, students can immediately calculate the results with ordinary fraction additions. However, if the number of fractions of the sum increases, it will be difficult to calculate. In order to exploit and promote students' creativity, teachers lead with questions so that students can discover the relationship between the elements and find an effective, concise, and easy-to-understand solution. In particular, the implementation of the sum S by analyzing fractions into a difference of two fractions through which students see the meaning of having to consider problems in both forward and reverse directions, thereby contributing to training their thinking.

Example 3. Sum

$$S = \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \ldots + \frac{1}{63.64}$$

This is a problem that requires calculating the sum of a series of numbers written according to the rules (as in example 2). Teacher asks students to answer the questions:

Looking at the total S, do you see anything special?

In which fractions can the fractions in the sum S be decomposed?

Did you notice the familiar point of this problem encountered in any previous problem?

After approaching the problem in example 2, students can easily associate it with the knowledge they have learned and the experiences they have had to perform the analysis:

$$\frac{1}{1.2} = \frac{1}{1} - \frac{1}{2}$$

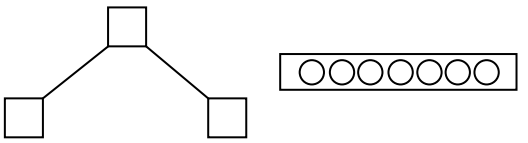
$$\frac{1}{2.3} = \frac{1}{2} - \frac{1}{3}$$

$$\frac{1}{63.64} = \frac{1}{63} - \frac{1}{64}$$

and from there it is easy to find a solution to this problem as well as similar mathematical forms.

b) Guide students to exploit and expand math problems

Example 4. From the problem of filling in numbers in Example 1, we can ask students to observe and color the circles and explain why they are coloring like that:



Different from Example 1 (the circles are grouped according to the numbers given in the diagram on the right), this time, students need to observe, analyze, find the relationship between the numbers and the shapes (circles as well as different ways to color), and must explain why they do that. Thereby, students see the exploitation and expansion of the problem, thereby developing their thinking capacity as well as increasing their interest.

Example 5 (Lesson 4, Math Textbook 5, page 176).

A shop selling fruit (fruit) earned 1.800.000 VND. Calculate a profit equal to 20% of the purchase amount. How much is the capital to buy that amount of fruit?

This is a problem about percentages, located in the 5th grade Math textbook. To guide students to solve this problem, the teacher asks students to read the problem carefully, find out the content of the problem (Problem for What is the relationship between the factors: selling money, interest, capital purchased?) from which to find solutions to the problem and ways to solve the problem.

Method 1. Since the profit is equal to 20% of the purchase amount, if you consider the purchase amount to be 100%, the profit will account for 20%.

At that time, the selling amount accounts for 100% + 20% = 120% (purchase amount).

The purchase amount is: 1.800.000: 120 x 100 = 1.500.000 (VND)

Answer: 1.500.000 (VND)

Method 2. Since the amount of profit is equal to 20% of the purchase amount, if the purchase amount is considered 100%, the profit will account for 20%. At that time, the selling amount accounts for 100% + 20% = 120% (purchase amount).

The amount of profit is: 1.800.000 :120 × 20 = 300.000 (VND)

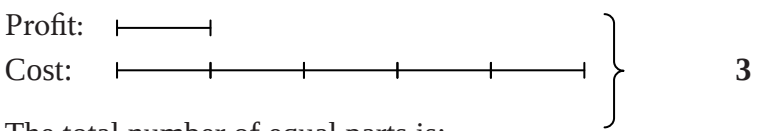
The purchase amount is: 1.800.000 - 300.000 = 1.500.000 (VND)

Answer: 1.500.000 VND

Method 3. Prompt students to return to the problem: Find two numbers when the sum and ratio of those two numbers are known.

It's easy to see: $20\% = \frac{1}{5}$

The problem can be illustrated as follow:



The total number of equal parts is:

1 + 5 = 6 (parts)

Amount to buy fruit is:

1.800.000 : 6 × 5 = 1.500.000 (VND)

Answer: 1.500.000 VND

From the above problem, it can be exploited and expanded to the following problems by changing the given data:

Problem 1. A store sells 4 balls of the same type to HAGL football team and earns

1 200 000 VND. Calculate that profit equal to 20% of the capital. How much is the capital of each ball?

Problem 2. A shop sells 4 balls of the same type to HAGL football team and makes a profit

240,000 VND. Calculate that profit equal to 20% of the capital. How much is the capital of each ball?

In Problem 1, the factors given are almost the same as in Example 4, but adjusted for the number of balls sold (4 balls) and required the student to find the cost of each ball. How much is the ball? Here there has been a change in the quantity of the input data as well as the requirement of what to look for.

In Problem 2, the factors given are almost the same as in Problem 1, but instead of giving the total amount of money earned from selling 4 balls, it shows the amount of profit (which is 240000 VND).

In the above two problems, if students do not understand the topic carefully, it is easy to get confused. These problems have changed the given factors, factors to find to help students understand the nature of the problem about percentages as well as practice thinking operations (analysis, comparison, synthesis, etc.)... of them.

Example 6. From example 3 above, students can be asked to generalize to the general form:

$$S = \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \ldots + \frac{1}{n.(n+1)}$$

With the same analysis as seen in Example 3, students can find a solution to the problem without much difficulty.

From the above problem, teachers can guide students to see that the denominator of each fraction in S is regular. If we expand the above problem in the direction of increasing the term in the product of the denominator, what will happen? The teacher asks students to exploit problem solving (comparing each term of S into the difference of two fractions) when applied to fractions:

$$\frac{1}{1.2.3} = \frac{1}{2}\left(\frac{1}{1.2} - \frac{1}{2.3}\right)$$

$$\frac{1}{2.3.4} = \frac{1}{2}\left(\frac{1}{2.3} - \frac{1}{3.4}\right)$$

Then the problem can be solved:

$$S = \frac{1}{1.2.3} + \frac{1}{2.3.4} + \frac{1}{3.4.5} + \ldots + \frac{1}{n.(n+1).(n+2)}$$

By doing the same, the following sum can be easily calculated:

$$S = \frac{1}{1.2.3.4} + \frac{1}{2.3.4.5} + \frac{1}{3.4.5.6} + \ldots + \frac{1}{n.(n+1).(n+2).(n+3)}$$

Example 7. For the purpose of helping students practice shape recognition, the teacher asks students to count the number of triangles in the following figure (Figure 6.1):

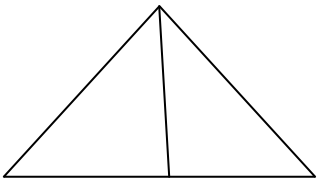


Figure 6.1

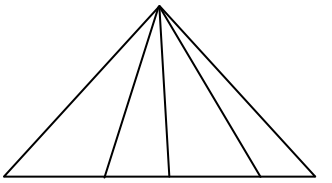
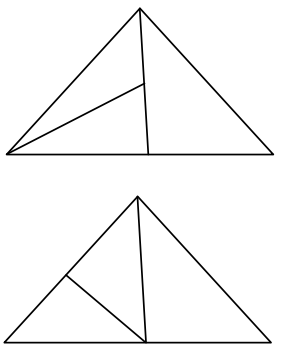
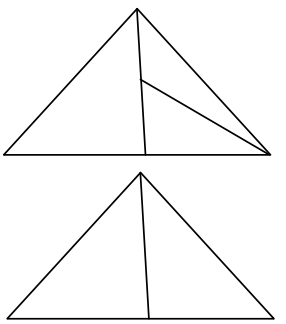


Figure 6.2

With the above problem, the teacher can exploit the direction of increasing the complexity of the figure (for example, Figure 6.2) and ask the students to tell the number of triangles in the figure. At this time, the request to count the number of triangles is a difficult request for students. They have to analyze and think about how to count to avoid confusion and repetition. However, with this requirement, students still solve problems based on drawings given by the teacher, thus somewhat limiting their initiative and creativity. In order to help students to have a better experience and help them train their thinking ability better, teachers can ask questions to exploit and expand the given problem. For example, from Figure 6.1, the teacher asks students to add a line to this drawing to get only 5 triangles. At this time, the number of triangles that need to be counted is known (5 pictures), but how to get these triangles with just an extra line (not available) should force students to think about finding the Different ways, even experience by drawing directly on the image to draw experience, thereby finding different ways. Students can point out the following lines.





Thus, with the exploitation and expansion of the problem from the original problem as above, it helps students practice thinking operations such as analysis, comparison, synthesis,... thereby contributing to the development of skills. thinking power for children.

4. Conclusions

Developing students' thinking capacity through teaching math is an important job in teaching Mathematics in primary schools, thereby contributing to the development of learners' abilities and qualities. But to accomplish this task requires a combination of different measures. One of the measures to help students develop their thinking ability is that in the teaching process, teachers need to pay attention to the system of exercises assigned to them that gradually increase in complexity, difficulty as well as difficulty. such as enhancing the exploitation and expansion of the given problems in the most suitable way for their students

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PHÁT TRIỂN NĂNG LỰC TƯ DUY CHO HỌC SINH TIỂU HỌC THÔNG QUA DẠY HỌC GIẢI TOÁN

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Từ khoá: *Năng lực tư duy, giải toán, tiểu học.*