

TRAINING THE SKILL OF TEACHING MATHEMATICS IN CONNECTION WITH REALITY FOR PRIMARY PRE-SERVICE TEACHERS THROUGH TEACHING SOLVING MATH WORD PROBLEMS

Nguyen Minh Giang - Hai Phong University

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Abstract: Formation and development of teaching capacity for primary pre-service teachers is an indispensable need to meet the new curriculum, textbooks and teacher career standards. It is necessary to have innovations in training teacher at pedagogical universities, including the practice of teaching of primary mathematics in connection to reality. The paper presents three training measures in practicing the skills of teaching mathematics in connection with reality for primary pre-service teachers through organizing activities using the mathematical modeling process in teaching solving math word problems.

Keywords: The skills of teaching, Mathematics in connection with reality, primary education, training teacher.

1. INTRODUCTION

In the field of teacher training, the results of research works in Tran Kieu (1988), Phan Van Ly (2016), Nguyen Canh Toan (2000), Hoang Tuy (2001), Tran Vui (2014) showed that teaching at teacher training universities now attaches great importance to teaching basic subjects without proper attention to pedagogical training, the training program is also very academic; training the vocational skill is mainly in favor of providing theoretical teaching methods, but it is not really associated with the reality of mathematics at all levels of education. In Tran Kieu (1988), the verdict about math teaching: "Due to many reasons, the teaching and learning math in the school in our country is now too light on the practice and apply mathematics to life"[p. 3-4]; according to Nguyen Canh Toan (2000): "Teaching and learning of mathematics is far from daily lives" [p 27-28]; according to Hoang Tuy (2001): "In math teaching in our country today, there is a preference for crammed teaching, memory training, tip teaching to solve complex and casuistic exercises which do not help much in intellectual development but make students more far distant from reality, tired and depressed" [p. 35-40].

In general teaching mathematics and in particular teaching primary mathematics, the majority of teachers have consciously innovative their teaching methods in order to promote students' positive studying by building problematic situations, giving directions, controlling students to find out problems,... to motivate and create learning excitement for students. However, teachers are

only interested and focused on completing the theoretical knowledge specified in the program and textbooks. Many math teachers tend to guide students to solve many mathematical problems, but they have not really paid much attention to the content associated with practical mathematics. Although most of the lessons in the primary math program may be in connection with reality.

The problem in pedagogical schools is there should be measures to train practical skills in teaching mathematics in connection with reality to develop teaching capacity for primary pre-service teachers to meet the new curriculum, textbooks and teacher career standards. The paper presents three training measures in practicing the skills of teaching mathematics in connection with reality for primary pre-service teachers through organizing activities using the mathematical modeling process in teaching solving math word problems.

2. LITERATURE REVIEW

There have been some studies on training teaching skills for students. For Nguyen Chien Thang (2012), in his PhD dissertation, introduced the solutions to train vocational skills for students of pedagogy in mathematics through teaching primary mathematics and methods of math teaching at the university; Do Thi Trinh (2013), in her PhD dissertation, presented how to develop the capacity of teaching mathematics for students of pedagogical schools; Nguyen Thi Thanh Van (2015), in her PhD dissertation, proposed the teaching advanced geometry at the university for

students of math pedagogy via preparing the capacity of geometry teaching in high school; Nguyen Duong Hoang (2008) introduced the organization process of teaching activities of math teaching methods oriented to enhance training of teaching skills for students in his PhD dissertation; Training pre-demonstrated skills for 5 grade pupils through teaching geometric elements was showed in PhD dissertation by Nguyen Thi Kim Thoa (2008). Specially, Phan Van Ly (2016) built 6 solutions to impact in teaching process of some subjects in primary mathematics for students of math pedagogy in the teacher training college to enhance using math in real situation to support student teaching capacities to teach secondary math in connection to reality.

As aforementioned, training the skill of teaching mathematics in connection to reality for primary pre-service teachers through teaching solving math word problems is still not considered and studied.

3. METHODS AND RESULTS

The results in this paper is based on the traditional research methods of educational science: theoretical research methods, applied research methods, and pedagogical experimental methods.

Applying the notion of “mathematical modeling is the whole process of transforming the real problem into a mathematical problem and vice versa, along with everything related to that process, from the reconstruction of the situation, realistic situations, deciding on a suitable mathematical model, working in the mathematical environment, explaining evaluation of results related to real situations and sometimes needing to adjust the model, until there is a reasonable result “referring to the four types of TH modeling processes (Kaiser and Blum’s Processes, Frank Swetz and JS Hartzler’s Process, The process of OECD / PISA) (Nguyen Minh Giang, 2016), we have proposed a five-step process for developing practical skill-based teaching skills for math professors that meet the teacher’s professional standards.

At the primary level, students develop mathematical knowledge primarily at the level of identification or discovery through visual activity. They just formed and practiced the first basic rules of mathematics; the requirement for inference and systematization is rather limited. Then teachers can hardly come from a mathematical situation to build up a mathematical knowledge that following often comes from a real factor and associate with the students' living

environment, including knowledge and skills in the subject area and other activities in the school; in which the mathematical problem is a convenient environment for teaching and learning mathematics in connection with reality.

For the requirement of the innovation in the training of mathematics teachers in the direction of developing the learners’ capacity as well as focusing on practical skills of teaching mathematics in connection to reality right in the process of training primary school teachers in teacher training colleges, in this paper, we propose three training measures in practicing the skills of teaching mathematics in connection with reality for primary pre-service teachers through teaching situations of solving math word problems.

3.1. Building the teaching processes for solving math word problem following the 5-step model of solving the mathematical problem in connection with reality to support students

In order to students perform the mathematical teaching in connection with reality, based on the theory of teaching primary mathematics, in particular, teaching situations is solving math word problem, focused on the characteristics of elementary pupils, characteristic of mathematics in elementary school,... along with the process of applying the mathematical modeling in Nguyen Minh Giang (2016) we build the teaching steps of solving math word problem for primary pupils to teach students as follows:

- ***Step 1: Teacher organizes pupils change the initial problem into concise, stagnant form.***

Arising from a math word problem (each math word problem often simulates a real situation), teacher let pupils concentrate on the basic elements of math, teacher needs to teach pupils knowing the early summary of the algorithm as a concise, most stagnant (eliminating the no focus elements, words can be removed or replaced by the symbol).

It is essential teacher to help pupils summarize to the most succinct problem (filtered out for the given and required data) - can consider the pupils know a preliminary model which a completely mathematical model is not necessary (like a transition to the presentation language in informatics).

- ***Step 2: Teacher guide pupils to show the elements of problem as the visualization diagram.***

Consider math word problem as summarized, use the intuitive tool of math (*Chart structure of the*

algorithm; drawings; Straight segment diagram; Rectangle Map, Venn Map, Arrow-type Graph, so on) to represent the elements, known quantities and unknown; Show the relationship between them as visual imagery.

It is essential pupil to change the model in step 1 to a model “pure math” - here is the form of a straight paragraph diagram, drawings with annotations, rectangular charts, Venn charts, diagram of the arrow type graph,... This is an important step so that they can figure out how to find the solution due to the visual expression of the given elements in the problem.

- **Step 3:** *Teacher guides pupils solving mathematical problem.*

Mathematical solving activity is conducted using the “mathematical tools” that pupils learn to solve the math: here there are the methods such as line diagram, rectangular chart, *Venn diagram, a graph-type diagram*,... that the basis of image-based visualization represents the relationship between known and unknown known quantities.

It is essential for pupils to perform solving arithmetic problems by some arithmetic methods in primary school.

- **Step 4:** *Teacher helps pupils turn the result of the initial question in math word problem.*

Pupils use the obtained results in step 3 and the expression language formation in steps 1 and 2 to respond to the actual calculation request in initial math word problem.

In fact, the children answer the question set out in initial math word problem based on the preliminary model in step 1 and the mathematical model in step 2.

- **Step 5:** *Teacher organize pupils check out the solution and creative reviews.*

Help pupils re-check the steps of solving math word problem to give the result with the given condition in math word problem.

- If possible, adjust the visual pattern: i.e. the expression of the mathematical structure in another form (in step 2): For example, switching from a straight-map form to a rectangle diagram, the Venn chart, the diagram of the arrow type graph,...

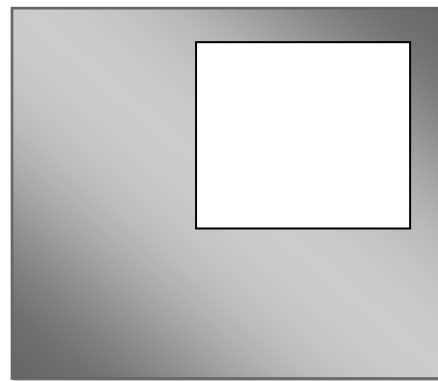
- Develop similar exercises (models and solutions), which can be achieved by other practical situations: for example, the calculation of motion to yield, time and output; or to the area...

- Generalizing expansion to have a generalized mathematical form.

3.2. Organizing training primary education students to practice the activities teaching mathematics in connection with reality through solving math word problem in primary school

Through professional lessons, the lecture organizes student using 5 steps of the above process, training by group to design and practice of organizing several teaching activities about solving math word problem for primary pupils.

Exercise: They extend a square pond of four sides as the drawing. After expansion, the pond area increased by 300m^2 and so the pond area is four times the old pond. How much do we need piles to be fenced around the new pond? Know how to pile those other than 1m.



- **Step 1:** Teacher guides pupil to do:

- Eliminate the no focus elements in the text: the pond, piles, fenced,...

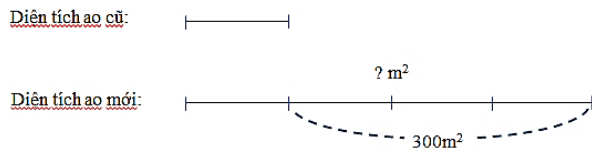
- Filter out the given and required facts of the problem:

- + Given: Figures; Large square area larger than the small square area is 300m^2 ; The square area is large with 4 times the area of the small square.

- + Request of the calculation: Finding the perimeter of the big square? Find the number of piles separated 1m?

- **Step 2:** Consider math word problem as summarized, use the intuitive tool of mathematics to represent the elements, known quantities and unknown; Show the relationship between them as visual imagery.

Performing diagram:



- **Step 3:** Using the mathematical tool to find the way and solve the algorithm.

Use the straight paragraph diagram method to find the area of the new square.

The new square area is: $300 : (4 - 1) \times 4 = 400$ (M2)

Use figures and square-shaped formulas to find the edges and perimeter of the new square.

The edge of the new square is 20m, as $20 \times 20 = 400$.

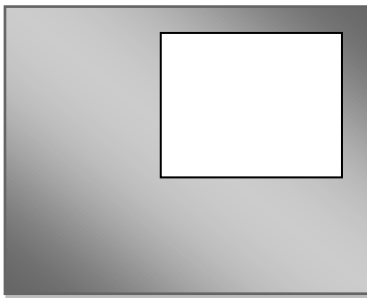
The perimeter of the new square is: $20 \times 4 = 80$ (M)

- **Step 4:** Shifting the mathematical results of actual situations:

Observe the drawing of students to see the number of piles needed to fence (separated 1m) around the new pond is the number of meters according to the edges of the new square, so the number of piles required for the fence is: Perimeter square 80(m): 1 (m) = 80 (s).

Answer: the number needed piles to fence around the new pond was 80.

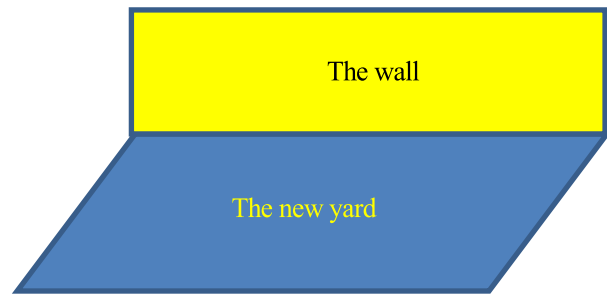
- **Step 5:** Extraction and expansion of the problem:



We exploit and expand the math by changing in real objects and situations, figure data and basic solution methods remain the same, shrinking the circumference of an edge and adding a perimeter to the area.

Exercise: The Sunflower School expands a square pitch on four sides as the figure. After expansion, the area rises to an additional 300m^2 and like the new yard area four times the old yard.

a/ Ask how many bricks is 20×20 cm in size to slice the new yard? (known as the mortar is negligible).



b/ On an edge of the new pitch, we want to build and decorate a wall with height 2,5m to serve teaching (see figure). Calculating the amount payable to the building and decorating the picture above? Know that the price for 1m^2 is 1250000 VND.

3.3. Organizing elementary education students to collect, select, build math word problem in connection to reality

In teaching section methods of teaching specific content in the primary math, the practice of students with routine and ability to collect, selectively, sort and use content with practicality; Directly contribution to train mathematical teaching skills in connection to reality for students, focusing on developing career capacity in training elementary school teacher.

To implement this solution, lecturer needs guide to primary school pedagogical students based on designing requirements and orientation, use math word problem in connection to reality as follows:

- The primary mathematics textbooks have a system of math word problems. However, to match the pupils in connection to reality, teacher need know how inheritance and adjust the form of expression, dividing multiple levels of requirement, additional some new exercises.

- On the other hand, math word problems put into mathematics in primary school based on knowledge, skills and abilities of pupils; to study Math from primary school to high school.

Apply the following techniques to select and build some math word problems to use in teaching math in elementary school.

*Review from the viewpoint of thinking manipulation:

- Building, choosing assignments similar with a type of given exercise;

- Building, choosing assignments is the special case of a type of given exercise;

- Building, choosing assignments is the general type of given exercises.

***Review from the teaching techniques and practical manipulation:**

- Increase the difficulty and complexity of the given exercise by:

+ Preserve the resources of the article, raise the request (change question: Ask more, ask hard).

+ Enhance the calculation skills by complex data (changes to more complex metrics).

+ Statements of facts calculus in a hidden form (indirect data expression).

+ Reduce the required requests (or increase the resolution of the solution).

- Reduce difficulty and complexity of the given algorithm by:

+ Shred questions (instead of aggregate questions with more simple questions).

+ Simplify the calculation metric (change for more simple metrics; focus on the solution method).

+ Some of the facts in the mathematical (direct-format data expression).

+ Give a side-up of the paper (questions or assignments).

The illustrated examples (Use the proportional divide method to solve the geometry problem)

Exercise 1 (originally released): Given ABCD Rectangle, the total length of the two edges of the rectangle is over 5 times the length of the two edges. The rectangular perimeter of its area is 600 cm².

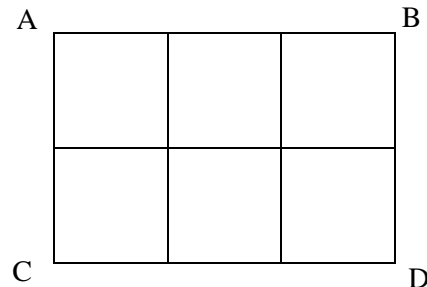
- Analysis: To calculate the circumference of the rectangle we must find the length of the two edges. Because the total length of two sides is five times the length of the two edges, the length of a half width is folded. Combined with the area of the rectangle is 600 cm² to find the length of two edges from which the calculation is the circumference of the rectangle.

- When this mathematical solution we use the method of proportional scaling and proceed to the following steps:

• Step 1: Draw shape: Divide the rectangular length into 3 equal portions and width into 2 equal parts. Then the rectangle was initially broken down into 6 small squares.

- Step 2: Calculate the area each small square.
- Step 3: Calculate the length of two edges, thereby calculating the circumference.

The solution:



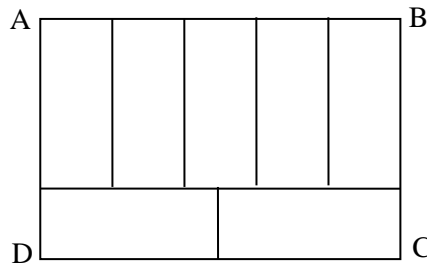
- Draw photos and observations:
- Each of the small square has an area of 100cm².
- The term is: the original rectangular length is 30cm; The rectangular perimeter is: 100cm.

Exercise 2 (Similar solving method): The rectangular ABCD is a circumference of 68cm, which is divided into 7 equal parts such as drawings. Calculate the ABCD rectangular area.

Analysis: To calculate the rectangular area we must go find the length of the two edges.

- From the drawings we can find the ratio between the two sides.

Article:



- Look at the drawings we see edge AB folds 5 times the width and 2-Fold Length Rectangle Small, so that the length of the small rectangular width is $\frac{5}{2}$.

- If a small rectangular width is 2 pieces, the length is 5 parts.

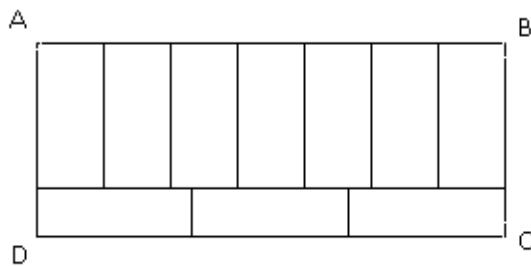
- The word is inferred by the length and width of the ABCD rectangle $\frac{10}{7}$.

- Scaling the AD width is 14cm, the AB length is 20cm, so the area is 280cm².

Exercise 3 (Advanced Difficulty). The garden of Minh is a rectangular circumference of 62cm, which is divided into 10 small pieces which are also rectangular with an equal area (like a drawing). Determine the Minh's garden area.

Analysis: Observe the drawings and argued similar to the above to find the length and width of the small rectangle $\frac{7}{3}$.

From there we have a solution:



- If the width of small rectangle is divided into two parts, the length will be 7 parts like that.

- Hence the width of the garden piece is 10 parts, the garden piece length is 21 parts and the area is 210cm².

4. DISCUSSION AND CONCLUSION

Organizing training for primary education students perform mathematical teaching in connection with reality to teach primary pupils solving math word problem is doing combination between supporting theory and practice the teaching activities solving math word problem following the 5-step process; as well as training student the skills of selection, building and using the problem in connection to reality in primary mathematical teaching.

Solution teaching theory with practice training is to help student training mathematical teaching skills in connection with reality, perform the request innovation of training primary mathematical teachers focusing on teaching capacity, to meet teacher standards.

Training teaching skills solving math word problem in connection with reality for students will help them to see the relationship between math and reality, the significant of math with life, positive learning, practicing career. Then they impact the excitation and result mathematical learning of elementary pupils, to help improvement the quality of the mathematical teaching and learning in primary schools.

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