VJE Vietnam Journal of Education, Vol. 2, 2018, pp. 35-39

IMPROVING ELEMENTARY STUDENTS' DIFFERENT LANGUAGE FORMS AND EXPRESSION THROUGH MATHEMATIC PROBLEM-SOLVING INSTRUCTIONS

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Received: 11/11/2017; Revised: 11/01/2018; Accepted: 12/01/2018.

Abstract: Developing language competence for students is a very important task in teaching. Mathematic language form, which has its own characteristics and advantages, plays a crucial role in Maths learning. Furthermore, developing mathematic language ability will contribute to the improvement of students' language competence. This paper discusses some language forms used in teaching mathematics in elementary schools and proposes some measures to develop students' language use through mathematic problem-solving instructions.

Keywords: Language competence, mathematic language, mathematic problem solving, elementary students.

1. INTRODUCTION

Language is the reflection of thinking so language development for students, especially for elementary students, will contribute to their thinking development. At elementary level, students start exploring the world and receiving basic scientific knowledge and language plays a major role in conveying knowledge through their cognitive process. In the general education program officially announced by the Ministry of Education and Training in July 2017, language competence is one of the specialized competences that need to be developed for students.

So far, there have been a number of studies focusing on the mathematic language development ways for students such as: the measures to develop the competence or practice the elementary students' ability to use mathematic language [1], [2], [3], [13]; the demonstrations on teaching some content or knowledge circuit to develop the ability to use mathematic language like [14], [15]; the ways to facilitate the mathematic language competence [5], [6], [9]; the challenges in term of language use in the Mathematics teaching and learning process [10]; the current Mathematics teaching in the multi-language classes or Mathematics teaching using second language (such as teaching Mathematics in English for non-English speaking students) [10], [11], [12].

This article focuses on some suggestions and orientation to help teachers improve their elementary students' language expression through mathematic problem-solving instructions, one of the most important activities in the process of mathematic learning.

2. CONTENT

2.1. Language Forms Used in Mathematics Teaching at Elementary Schools

2.1.1. Spoken Language

Spoken language is the basic language form in communication, and at elementary level, most students are fluent at using oral language. In the teaching process, teachers can check students' understanding as well as elicit their difficulties, thoughts and views on a certain issue through their verbal communication. On the base of mathematics teaching at elementary level, students' spoken language is improved when they present their ideas in front of the group/class, answer the teacher's question about the lesson, and share their ideas of the assignments within their group or in class.

2.1.2. Written Language

Along with spoken language, students' written language is gradually formed and developed in the learning process at elementary schools. In the final grade, the written language of elementary school students is more advanced in terms of grammar, spelling, and phonetic use. Through mathematic learning, elementary students gradually become familiar with presenting the solution to mathematical problems in a logical manner from simple practice of rewriting given samples to more

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complicated practice self-presenting the solution to the problem, especially solving word problems.

2.2. Mathematic Language Form

Mathematic language is a system of mathematic terms and symbols, mainly in the form of written language. These symbols are conventional to express mathematical content that is logical, accurate, and concise [1].

Mathematic language is different from natural language as mathematic language is more compact than natural language because it mainly uses alternative symbols (mathematic symbols, diagrams, graphs, and illustrations) to express the content to be presented. Moreover, each mathematic symbol or combination of mathematic symbols has only one meaning, which makes the mathematic language capable of expressing mathematic thought more precisely than natural language. The mathematic symbols in the elementary mathematics program can be divided into groups of *quotation symbols* (plus "+", minus "-", multiple "x", divide ":"), or groups of *relationship symbols* (greater than ">", smaller than "<", equal to "=", etc.)

Mathematic language activities can be performed at any time in the mathematics learning process for elementary school students. Teachers should help students get familiar with it and improve the ability in integrating oral language, natural language and mathematic language in the mathematic teaching and problem solving.

2.3. Teaching Mathematic Problem Solving at Elementary Level

Mathematic problem-solving instruction is an activity aimed at developing the content of knowledge circuits in the mathematics curriculum in elementary schools. This content is integrated into new and practice lessons in all circuits like arithmetic knowledge, quantity and quantity measuring, geometry, etc., and taught from grade 1 to grade 5 with the gradually increasing amount of knowledge.

Through mathematic problem-solving instructions at elementary schools, teachers help students practice, consolidate, enhance calculating skills, and apply knowledge into practice so as to gradually develop their thinking competence and sharpen their way of thinking and reasoning as well as their ability to observe, compare, analyze, synthesize, explore, and create, etc.

Mathematic problem-solving teaching does not only mean providing students with the problem solution but more importantly assisting students to know how to solve the problems. Therefore, the mathematic problem-solving instruction should equip students with instructions and suggestions so that they know how to think and analyze the problem to find out the solution. According to Nguyen Ba Kim [7], based on general ideas along with the detailed suggestions of Polya, the general process for solving a mathematic problem should follow four steps as follows:

Step 1. Understand the problem

In this step, students carefully read the mathematic problem. Then they can restate the problem in different ways to understand the problem content; determine what is given, what must be found or proven; use formulas, symbols, and graphics to support the description of the problem.

Step 2. Devise a plan

In this step, students explore the solutions through speculative inferences: transform the given, what to be found or proven, relate the given to what to be found with known knowledge, relate the solving problem to a similar former problem, a particular case or a more general case or use specific methods for each type of mathematic problems.

Step 3. Present the solution

Basing on the solution that has been found, students rearrange the steps to be done in a process with appropriate order and perform those steps.

Step 4. Reflection

In this step, students consider the applicability of the solution, find solutions to similar problems, expand or reverse the problem to develop the problem.

It should be noted that some problems do not necessarily follow in the above steps, but the implementation of these suggestions will help learners find the direction, find solutions to the problem or explore and expand that problem.

2.4. Some measures to improve the expression ability of different language form for elementary school students through mathematic problem-solving instructions

2.4.1. Communication between teachers and students in the process of solving mathematic problems

The communication between teachers and students in schools aims to help the children acquire scientific knowledge, living experiences, professional skills and techniques for the formation and development of

students' comprehensive personalities.

In the process of teaching Mathematics in general and teaching mathematic problem solving at elementary schools in particular, teachers can communicate with students by leading, raising the problems, and posing questions about the problems while students answer teacher's questions in problem solving process to develop their ability to use the language.

Example 1. *There are two barrels of oil, the first one contains 15 liters of oil and the second one has 27 liters of oil. The oil is then equally put into different bottles of 0.75 liters each. How many bottles of oil will there be?*

With this problem, after asking the students to study the task carefully, the teacher asks the students to answer such questions:

"What do you know?" (The first container contains 15 liters of oil, the second container has 27 liters of oil, the oil is equally divided and each bottle contains 0.75 liters of oil.)

"What do you have to find out?" (How many bottles of oil are there?)

During the question-and-answer process between the teacher and students to find out what has been given and what must be worked out, the teacher can ask extra guiding questions to assist students to understand the problem content and requirements.

Once the students have learned the content and requirements of the mathematic problem, teacher continues to ask students to write a summary of the problem. This can be done by underlining keywords in the problem or rewriting key information. This requirement helps students understand the problem better, ignore the unnecessary words and help students gradually get familiar with the short, clear but accurate writing in mathematics.

In the next step, teachers can ask questions to guide students to find the solutions:

"Do you know the amount of oil in the two barrels?" (the oil amount must be figured out)

"How do you know the number of oil bottles?" (total amount of oil is divided by the amount of oil in each bottle)

In order to exploit and expand the problem, the teacher can ask the student to show the relationship between the number of bottles and the amount of oil contained in a bottle through the supposed cases: *How many bottles of oil will be needed if each bottle contains 1 liter of oil? How many bottles will be needed to store all the oil if each contains 0.5 liter?*

It can be said that in the process of mathematical problem-solving teaching, through the problem-understanding step, and solution-finding step, elementary students have chances to practice their spoken language (by answering teachers' questions), written language and mathematic language.

2.4.2. Presentation of the solution

In step 4 of mathematic problem solving process, after studying the problem, analyzing the problem-solving direction and the solution, students move to the solution presentation step, which represents the result of the mathematic problem solving. Presenting a solution to a problem is a form of applying knowledge to specific problems, which is the best way to practice such skills as calculating, transforming, reasoning, as well as to check the students' ability to master and apply learned knowledge.

However, in reality, many students do not care about the presentation step as they try to present the solution in their own way of thinking and understanding, which results in illogical solutions. Many students can be able to identify the key points, the direction to solution after analyzing the problem, but what challenges them is that they do not know where to start presenting the solution, and some may make mistakes. In order to develop the problem solving presenting skills, teacher can *demonstrate an example then analyze the students' points of interest* so that they can learn the way of presenting a solution. This is a very important activity, especially for elementary school students, which requires teacher's demonstration for each mathematic problem form and the analysis of each step of reasoning so that students can observe, study and follow. It should be noted that the goal of the teacher demonstration is not only the application of the students into similar mathematic problem form, but a concentration on improving the skills of thinking and ordering their reasoning accurately, properly and scientifically.

In addition to learning how to present the solution basing on samples, teacher can give incomplete suggestions or instructions of the solution and ask students to present the complete solution to the given problem.

Example 2. A rectangular shaped land plot is 200m in length, and its width is the same. Calculate the area of the land plot?

With this problem, from the analysis of what is known, what must be found and the relationship between

them, students learn that the area of the rectangular shaped land plot can be calculated if its length and width are known. Teacher can ask students to answer the following questions to complete the solution:

- *How can we calculate the area of rectangular shaped land plot? (the length multiples the width)*

- *What is the length of the rectangular shaped landplot? Do you know it? (200m)*

- *Can you calculate the width of the rectangular shaped landplot? (can be calculated based on the length)*

2.4.3. Detecting and correcting errors in mathematic problem solution

When presenting the solution to mathematic problems, students are more likely to encounter errors in their solutions. Detecting and correcting these errors not only helps them complete their assignments but also helps them avoid the errors. At the same time, through the process of analysis and correction of errors, teachers can help them better perform the ability to express their language.

Teachers may ask students to find the mistakes (if any) in a student's answer, as follows:

Example 3. The first garden harvested 32 kg of vegetables, the second one yielded three times as much as the amount of vegetables of the first garden. Each kilogram of vegetables can be sold at 15,000 VND. How much money could be earned from the vegetables of both gardens?

Solution:

Vegetable harvested in the second garden is:

32 x 3 = 96 kg

Vegetable harvested in both garden is:

32 + 96 = 128 kg

Money earned from the vegetable is:

128 x 15.000 = 1920000 VND

Answer: 1.920.000 VND

In the above solution, there are some errors needed correcting: The writing of "*Vegetable harvested in the second garden is*" or "*Vegetable harvested in both gardens is*" is not a correct expression as this refers to the amount of vegetables harvested. The writing should be "*The amount of vegetable harvested in the second garden is*" and "*The amount of vegetable harvested in both gardens is"*. The next writing *"Money earned from the vegetables is*" should be written as "*The amount of money earned from the vegetable is"*. Furthermore, the presentation of the solution is not precise because there are not brackets for the quantity unit (except the answer).

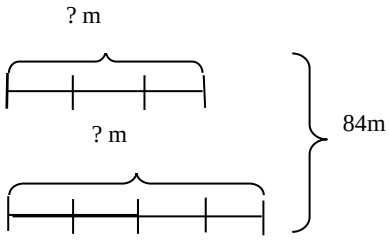
Teachers should help students in detecting and analyzing errors and let them correct these errors by themselves and learn from their own experiences.

2.4.4. Exploring some advantageous mathematic problem form for the development of students' language and language expression ability

At elementary level, there are a number of mathematic forms which can be utilized to improve students' ability to present, express and develop their language such as word problems, information filling problems, multi-solution mathematic problems, mathematic problem using diagrams, etc.

The following is an illustration of the problem requiring students to set up the problem by themselves and solve the problem basing on some given data.

Example 4. Write down the problem basing on the given data, then present your solution.



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Usually, students are accustomed to confronting with a word problem associated with the actual content expressed, they just have to find the solution as required. But in this case, the exercise provides some information about the relationship between the quantities, and asks the students to use appropriate language to set up various real problems before solving it. At this stage, students are put in a problematic situation in which they do not go straight to the solution but analyze the problem and given data, and their relationship in order to be able to 'compose' the problem first. They have to find ways to express the problem which is related to the given diagram for both mathematical and practical requirements.

Some of student's proposed math problems can be listed as follows:

(1) A rectangular shaped garden has a half-perimeter of 84m. Calculate the length and width of the garden, given that the width of the garden is $\frac{3}{4}$ of its length.

(2) A rectangular shaped garden has a half-perimeter of 84m. Calculate the area of the garden, given that the width of the garden is $\frac{3}{4}$ of its length.

(3) One team dug a 84 m long ditch in two days. Due to technical innovations, the ditch was dug more $\frac{4}{3}$ than that of the first day. Calculate the length of ditch the team dug each day.

Thus, 'composing' the mathematic problems basing on given data not only helps students develop their thinking, imagination, creativity but also train their language use, symbol, transformation, and application of the learned knowledge. More importantly, it encourages students to move from being passive (waiting for the problems solved by the teacher) to being more active (getting the task, setting up the problem, then solving it).

3. CONCLUSION

Language development is one of the ultimate goals in elementary education. Among various subjects, mathematics is a potential subject that equips students with both knowledge and skill, and contributes to the development of students' language. During the mathematic problem-solving instructions in elementary schools, based on the above discussed suggestions, teachers know how to organize the activities for students and utilize advantageous mathematic problem forms so as to improve the students' language expression ability and thus their language competence.

REFERENCES

[1] Tran Ngoc Bich (2013). *Some measures to help students in the first grade of elementary school to use mathematical language effectively*. PhD thesis, Institute of Educational Science.

[2] Tran Ngoc Bich (2013). *Developing communication skills through mathematic language for first grade students at elementary schools*. Vietnam Journal of Education, No. 320, pp. 47-50.

[3] Tran Ngoc Bich (2013). *Forming and practicing mathematic language for first grade students at elementary schools*. Vietnam Journal of Education, No. 313, pp. 47-50.

[4] Vu Quoc Chung (Chief Editor) - Dao Thai Lai - Do Tien Dat - Tran Ngoc Lan - Nguyen Hung Quang - Le Ngoc Son (2007). *Methods of teaching Mathematics at elementary level*. Education Publishing House.

[5] Maaike Hajer - Eva Norén (2017). *Teachers' Knowledge about Language in Mathematics Professional Development Courses: From an Intended Curriculum to a Curriculum in Action.* EURASIA J. Math., Sci Tech, Vol. 13(7b), pp. 4087-4114.

[6] Nguyen Huu Hau (2011). *Practice for students to develop mathematical language in the process of teaching mathematics.* Vietnam Journal of Education, No. 253, pp. 46-49.

[7] Nguyen Ba Kim (2006). *Methods of teaching mathematics.* University of Education Publishing House.

[8] Norén, E. (2015). *Agency and positioning in a multilingual mathematics classroom.* Educational Studies in Mathematics, Vol. 89(2), pp. 167-184.

[9] Rose, D. - Martin, J. R. (2012). *Learning to write, reading to learn: Genre, knowledge and pedagogy in the Sydney School*. Sydney: Equynox.

[10] Schleppegrell, M. (2007). *The Linguistic Challenges of Mathematics Teaching and Learning: A Research Review.* Reading & Writing Quarterly, Vol. 23, pp. 139-159.

[11] Smit, J. (2013). *Scaffolding language in multilingual mathematics classrooms*. Utrecht University: Utrecht.

[12] Schleppegrell, M. J. - O'Hallaron, C. L. (2011). *Teaching academic language in L2 secondary settings.* Annual Review of Applied Linguistics, Vol. 31, pp. 3-18.

[13] Pham Thi Thanh Tu (2015). *Some measures to develop the ability to understand and use mathematic language for elementary students.* Vietnam Journal of Education, No. 356, pp. 51-53.

[14] Thai Huy Vinh (2013). *Designing the teaching lesson "Parallelogram" (Grade 4) towards language approach.* Vietnam Journal of Education, No. 304, pp. 50-52.

[15] Thai Huy Vinh (2013). *Forming and practicing the use of mathematic language for grade 4, grade 5 students in teaching the knowledge circuit "Quantity and quantity measurement"*. Vietnam Journal of Education, No. 320, pp. 40-42.