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DEVELOPING MATHEMATICAL COMMUNICATION COMPETENCE FOR PRIMARY SCHOOL SENIORS THROUGH TEACHING MATHS WORD PROBLEMS SOLVING

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THE AUTHOR'S PUBLICATIONS
RELATED TO THE DISSERTATION TOPIC

1. Dang Thi Thuy (2014), "Developing the skills of solving maths word problem for primary school students", *Journal of Education*, May issue (pages 157 - 159).

2. Tran Trung, Dang Thi Thuy (2016), "Teaching Maths word problems solving for primary school students through creative experiential activities", *Journal of Educational Science*, special issue January 2016 (pages 11 - 12).

3. Le Thi Thu Huong, Trinh Thi Phuong Thao, Dang Thi Thuy (2016), " Developing the skills of building maths word problems for primary school students", *Journal of Educational Science*, No. 130 - July/ 2016 (pages 57 - 59).

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5. Dang Thi Thuy (2019), "The reality of developing mathematical communication competence for primary school seniors through teaching Maths word problems", *Journal of Education*, special issue October 2019.

6. Dang Thi Thuy (2019), "Several measures to develop mathematical communication competence for primary school seniors through teaching Maths word problems ", *Journal of Education*, December special issue 2019.

7. Dang Thi Thuy, Phan Anh Hung (2021), "Develop the skills of presenting and expressing mathematical contents and ideas for primary school students through teaching Maths word problems, contributing to the development of mathematical communication competence", *Technology and education*, Hanoi National University Publishing House.

8. Phan Anh Hung, Dang Thi Thuy (2021), "Developing skills of listening, reading, and recording mathematical information in math word problems, contributing to the development of mathematical communication competence", *SCIENTIFIC PROGRAM International Conference on "Competency-based Curriculum Development and Continuous Professional Development for Teachers and Education Managers"*

INTRODUCTION

1. Reasons for choosing the research topic

1.1. Primary education is the foundation level of the general education system, laying an important foundation for continued learning at higher education levels. Therefore, it is very important to organize learning activities for students to help them acquire knowledge and know how to express that knowledge in communication activities. The level of formation of study skills will greatly affect the quality of students' learning at the next education level.

1.2. In the primary school curriculum, Mathematics has a great position and importance. Mathematics plays an important role in laying the foundation for the formation and development of personality for students. On the basis of providing initial scientific knowledge about arithmetic, natural numbers, decimal numbers, basic quantities, strategies for solving Maths word problems that have practical applications in life and a number of factors and some simple geometry.

1.3. Mathematics is very diverse and rich, with many types of problems in many different forms, among which, Maths word problems always hold an important position because it reveals the interrelationship with other subjects as well as in real life. Maths word problems appear at all stages of the teaching process in primary schools, from the formation of concepts and calculation rules to the direct formation of calculations, and the synthesis of knowledge and skills in arithmetic, algebra, geometry...

1.4. In the process of learning math, students need to communicate with classmates and teachers to understand the problems they encounter and share their solutions. Vietnamese students can master math algorithms and rules, but not be successful in solving unfamiliar problems that they don't have a solution to before. Mathematical communication creates positive interactions, which can support students to firmly grasp the basic mathematical knowledge that has been studied in many developed countries.

Stemming from the above reasons, we choose the research topic for the thesis: ***"Developing mathematical communication competence for primary school seniors through teaching Maths Word Problems Solving".***

2. Research Aims

On the basis of theoretical research on mathematical

communication competence and practical mathematical communication competence of students in grades 4 and 5 at primary schools, we would like to propose some measures to develop mathematical communication competence while teaching Maths word problems solving for students, thereby contributing to improving the quality of teaching Grade 4 Maths and Grade 5 Maths.

3. Research subjects and objects

- Research subjects: Pedagogical measures that contribute to the development of mathematical communication competence for primary school seniors (grade 4, 5) in teaching Maths word problems.

- Research objects: The process of teaching and developing mathematical communication competence for students while teaching Maths word problems solving in grades 4 and 5.

4. Research scope

The thesis focuses on studying a number of theoretical and practical bases to implement measures to develop mathematical communication competence for primary school seniors (grades 4, 5) in teaching Maths word problems solving.

5. Scientific hypothesis

If some pedagogical measures are successfully proposed and organized, it is possible to develop mathematical communication competence for both teachers and students, contributing to improving the quality of math teaching in grades 4 and 5 in particular and the quality of teaching primary mathematics in general.

6. Research tasks

3.1. Study the concepts of mathematical communication and the development of students' mathematical communication competence in teaching mathematics in high schools through a number of works by some domestic and foreign authors closely related to the thesis topic. At the same time, study some theoretical issues on mathematical communication and teaching Maths word problems solving.

3.2. Investigate the current situation of mathematical communication in teaching Maths word problems solving in grade 4 and grade 5 in primary schools.

3.3. Propose a number of pedagogical measures to develop mathematical communication competence for students in teaching grade 4 and grade 5 maths in primary schools.

3.4. Implement pedagogical experiment to test the effectiveness and feasibility of the proposed measures.

7. Research Methods

7.1. Theoretical research methods: Using analytical and synthetic methods maintained throughout the research process. Theoretical research methods are used to select, collect, and analyze theoretical issues related to teaching and developing mathematical communication competence for primary school seniors in teaching Maths word problems.

7.2. Practical research method: Using interviews, questionnaire surveys and pedagogical observations to investigate the current situation, thereby assessing the mathematical communication competence of primary school seniors in teaching Maths word problems solving in some primary schools in Thai Nguyen and Lang Son provinces.

7.3. Pedagogical experiment

7.3.1 Expert method: Consult experts who are scientists specializing in theories and methods of teaching mathematics, including researchers and math lecturers working at research institutes and universities in the country, and especially teachers who are directly teaching math in primary schools via interviews, face-to-face discussion or survey questionnaires.

7.3.2 Observational method: Observe the pedagogical experiment teaching lessons that apply the proposed methods in teaching to collect qualitative and quantitative information about the manifestions of mathematical communication of grade 4 and grade 5 students which teaching Maths word problems. The collected information serves as the basis for proving the scientific hypothesis.

7.3.3 Case-study method: Select from each experimental class 2-3 students representing the class; monitor the manifestations of the development of mathematical communication competence of the students in the process of pedagogical experiment, interview, discussion; and continuously adjust pedagogical impacts on the selected subjects to observe more clearly the influence of the pedagogical measures on the development of students' mathematical communication competence.

7.3.4. Mathematical statistical method: Design a test after the pedagogical experiment for students of experimental and control classes. Scoring and using statistical methods to process test data. Compare the test results of students in the experimental class and the control class to draw conclusions about the improvements in the learning outcomes of students in the experimental class after being taught with the application of the designed pedagogical measures.

8. Contributions of the thesis

- Theoretical contributions: Based on the results of studying domestic and foreign research works, we have analyzed and clarified the concepts of communication competence, mathematical communication competence, levels of evaluating the mathematical communication competence of primary school seniors and concretize the manifestations of the students' mathematical communication competence in teaching Maths word problems solving, and at the same time evaluate those manifestions according to the criteria of five levels.

- Practical contributions: We have researched, surveyed and evaluated the current situation of developing mathematical communication competence of grade 5 students in teaching Maths word problems in primary schools in Thail Nguyen, Bac Giang and Lang Son provinces. Based on the results of theoretical research and reality survey, we have built 05 specific pedagogical measures to contribute to the development of mathematical communication competence in teaching Maths word problems solving for primary school seniors.

9. Arguments to be defended

- Mathematical communication competence includes four groups of manifestions divided into five levels, and at the same time, the teaching content of math word problems solving has potentials and many advantages to develop students' mathematical communication competence.

- Currently, there are still many primary school teachers who are not interested or have many difficulties in teaching Maths word problems solving in the direction of developing students' mathematical communication competence.

- The feasibility and effectiveness of measures to develop mathematical communication competence for students in teaching Maths word problems solving in grade 4 and 5 math programs.

10. Thesis structure

In addition to the Introduction, Conclusion and References; the thesis content consists of 4 chapters

Chapter 1: Theoretical and practical basis of the research topic.

Chapter 2: Measures to develop mathematical communication competence for primary school seniors in teaching Maths word problems solving.

Chapter 3: Pedagogical experiment.

The thesis includes 79 references and 04 appendices.

Chapter 1. THEORETICAL AND PRACTICAL BASIS

1.1. Literature review

1.1.1. Foreign research works

1.1.1.1 Communication competence

The mathematics education materials emphasize the importance of establishing communication problems in math classrooms and offers a number of specific strategies teachers can use to promote students' mathematical communication (Chazan & Ball, 1999; NCTM, 2000; Silver & Smith, 1997; Maria, 2015)

According to Karen K. Clark (2005), effective communication is now seen as a skill that students must demonstrate in all fields, not just in the areas of language arts and social sciences. Indeed, the role of mathematical communication is increasingly being emphasized and considered as a necessary condition to ensure the effectiveness and quality of learning mathematics.

Brandee (2009) suggested that teachers need to create opportunities for students to develop communication skills in both oral and written forms. Students' understanding levels will increase when they can express their ideas in different ways. Through discussion and sharing of ideas, students can find the best learning method for them. Students' understanding of math is deepened by asking questions or providing their solutions for peer review, evaluation, and feedback.

There are also studies by Laborde (1982), Coquin - Viennot (1989), Duvai (1989) in France, Boero (1989) and Ferrari (1989) in Italy, Patronis in Greece. These studies also bear many similarities with the above studies; they have affirmed the role of language and communication in teaching Mathematics, verbal language and communication problems of mathematical language is very important.

1.1.1.2. Teaching Maths word problems solving

In essence, the content circuit of solving Maths word problems in the primary school program is the problems associated with reality, the application of mathematical knowledge to the daily life around the children. This is a teaching goal not only of any particular school or country, but a common goal around the world. This problem has been studied by many scientists around the world. In 1993, UNESCO established the International Council on Education for the 21st Century to assist countries in exploring the best way to reconstruct their education for sustainable human development; the motto is to

consider education as the function of preparing the workforce for society. In 1996, the Council published the publication “Learning: a hidden treasure”. Researches around the issue of "learning to do" are closely related to the study of teacher's pedagogical capacity; mathematical competence, the ability to apply mathematics of learners and studies on the application of specific mathematical knowledge to specific practical areas.

1.1.2. In Vietnam

1.1.2.1. Communication competence

The textbook "Mathematics language" by Nguyen Duc Dan (1970) provides a number of methods and presents some basic concepts, theorems and how to apply mathematical logic and set theory for students to describe and explain various linguistic phenomena;

Nguyen Ba Kim (2015) wrote “Teaching through organizing activities for students, enhancing individual learning combined with cooperative learning. Developing skills in using correct language, fostering thinking qualities such as flexibility, independence and creativity. Initially forming for students the habit of self-study, communication competence, including the ability to accurately express their own ideas and understand the ideas of others.

Hoang Chung (1994) researched on mathematical language and the use of mathematical language in secondary school math textbooks. According to the researcher, in mathematics, different symbols can be used to refer to the same object; however, we can not use the same symbol to refer to two different objects in the same matter.

The doctoral thesis by Nguyen Van Thuan (2004) "Contributing to the development of logical thinking capacity and correct use of mathematical language for students at the beginning of high school education in teaching Algebra". The thesis shows a number of difficulties and mistakes that students encounter in solving math problems, which are mainly caused by limited ability to think logically and correctly use mathematical language.

The doctoral thesis by Tran Ngoc Bich (2013) has proposed three groups of measures, including measures to develop communication skills in mathematical language: Developing listening - speaking skills and Developing reading – writing skills for students in learning math.

The doctoral thesis by Hoa Anh Tuong (2014) with the topic

"Using lesson study to develop mathematical communication competence for lower-secondary school students" has studied the mathematical communication competence of middle school students: Visual representations effectively support students to communicate mathematically. The harmonious combination of representations well supports students to create new math knowledge. For students, visual representations create an effective math learning environment.

1.1.2.2. Teaching Maths word problems solving

The issue of teaching Maths word problems in primary schools is also a research topic of interest to many scientists. Notably, Do Dinh Hoan, within 4 years from 2002 to 2006, published a set of books on "Q&A about teaching Grade 1 Math (Grade 2, Grade 3, Grade 4, Grade 5 Maths)" in which many questions and specific examples are very typical and common in teaching Maths word problems in primary school. Next, the primary teacher development project documents (2006) on the issue of "Innovation in teaching methods of mathematics in primary schools" also deeply studied the issue of teaching mathematics in primary schools.

Concerning the cognitive issues of primary school students, the researchers Vu Quoc Chung, Tran Ngoc Lan and others (2007) when writing the textbook "Methods of teaching mathematics in primary school" said: *Thinking of primary school students are in the "concrete thinking" stage, which is not yet complete, so the perception of abstract and general mathematical knowledge is difficult for them. In teaching, it is necessary to master the lawful development of students' thinking. Therefore, it is necessary to propose pedagogical measures appropriate to the level of psychological development and suitable to the perception of mathematical knowledge in primary school.*

In addition, the authors Do Tien Dat, Pham Thanh Tam, Nguyen Ba Minh (2008) have some typical articles such as "Methods of teaching Mathematics in Primary School", "Skills for teaching Mathematics in Primary School". It can also be seen that the content of teaching Maths word problems for primary school students is studied in different research angles.

1.1.3. Some comments

Domestic and foreign research works on mathematical communication and teaching Maths word problems presented above point out the following problems:

- The concepts of communication and mathematical

communication under different authors' perspectives are diferent. However, there is agreement on the role of mathematical communication in teaching mathematics. Mathematical communication competence is an important and necessary competency for students. Communication is not only a means for learners to express their mathematical knowledge, but also plays an important role in understanding, absorbing and forming new mathematical knowledge.

- Many studies on mathematical communication refer to students' mathematical communication competence expressed through speaking and writing math. We agree with this point of view, however, in addition to speaking and writing as the two main forms, listening to math and reading math are also ways to show learners' mathematical communication competence.

In summary, the research works and articles in the country and abroad of the above authors revolve around the following issues: concepts of mathematical language, mathematical communication, difficulties and barriers of students in mathematical communication, the meaning of language in teaching Mathematics in high schools. These issues affirm that training and developing students' communication competence through teaching mathematics is a positive measure to improve the quality of their comprehensive learning. However, there is no research document on developing students' communication competence through mathematical contents, specifically solving Maths word problems.

1.2. Learning characteristics of primary school seniors

For primary school seniors, we can pay attention to some of their cognitive characteristics as follows:

Perception: The perception of primary school students is general, less detailed and unstable.

Thinking: Thinking of children at the end of primary school gradually shifts from concrete to general abstract thinking.

Imagination: At the end of primary school education, reconstructive imagination has begun to mature; from old images young children have recreated new images.

Language: Most primary school students are fluent in spoken languages. By grade 4, 5, the written language has gradually become proficient and begins to improve in terms of grammar, spelling and phonetics.

Attention: At the end of primary school education level, children gradually form skills to organize and regulate their attention.

Memory: In grades 4 and 5, meaningful memorization and word retention are enhanced. Intentional memory has evolved.

Willpower: At the end of primary school education level, children have the ability to turn adult requests into their action goals.

1.3. Teaching Maths word problems for primary school seniors

1.3.1. Objectives of teaching Maths word problems for primary school seniors

For primary school seniors, the goals of teaching Maths word problems are:

- Students are able to solve compound problems with no more than 4 steps involving typical math types and some atypical math types.

- Students are able to present a complete solution including detailed solutions (each calculation has words) and the correct answer according to the requirements of the problem.

- Good and excellent students are able to find many ways to solve a problem (if any) and create new math problems from the forms of math already done.

1.3.2. The contents of teaching Maths word problems solving at the end of primary school education, comparing the current program and the primary education program after 2020

Inheriting the contents of solving math in grades 1, 2, and 3 and expanding and developing the contents of solving math to suit the cognitive development of students in grades 4 and 5, the contents of math is arranged in a logical order and interwoven with geometrical contents (area and perimeter of a square and rectangle...) and units of measurement, in order to meet the goals of Grade 4-5 math program.

In addition, the contents of math problems in grades 4 and 5 has paid attention to practicality, associated with life, close to children, enhancing education for students.

1.4. Mathematical communication competence of primary school seniors

1.4.1. Communication competence

1.4.1.1. Communication

There are many different views on communication, but it can be generalized into a widely accepted concept as follows:

Communication is the process of exchanging information, emotions, and thoughts; influence each other in relationships between

people to achieve a certain goal.

1.4.1.2. Competence

Competence is primarily a set of elements "knowledge" and "skills" to do something (problem solving or project implementation), which must be placed in a specific "situation".

1.4.1.3. Mathematical communication competence

- Communicative competence is the ability to present and express one's thoughts, opinions, needs, desires and feelings in the form of speaking, writing or using body language in an appropriate manner to the communication partner, communication situation and culture; at the same time read, understand, listen and respect the opinions of others even when disagreeing.

Mathematical communication competence is the ability to use numbers, symbols, pictures, charts, diagrams, and words to express ideas, solutions, mathematical content, and understanding by speech, eyes, gestures and in writing appropriate to the object of communication; at the same time, read, understand, listen, absorb and respect the opinions of others.

1.4.2. Manifestations of mathematical communication competence of primary school seniors

Table 1.2. Manifestations of mathematical communication competence components

No.	Component competencies	Descriptions
1	Listen, understand, read and record essential mathematical information presented in mathematical text or spoken or written by others	Listen, read, and record (summarize) key mathematical information in written content or announced by others (at a simple level), thereby identifying problems that need to be solved.
2	Present and express (oral or written) mathematical contents, ideas and solutions in interaction with others (with appropriate requirements for completeness and accuracy).	Present and express (spoken or written) mathematical contents, ideas and solutions in interaction with others (not yet required to express fully and accurately). State and answer questions when reasoning and solving problems
3	Effectively use mathematical language (digits, letters, symbols, charts, graphs, logical links, ...) in combination with common language or physical movements when presenting and explaining and evaluate mathematical ideas in interaction (discussion, debate) with others	Effectively use mathematical language in combination with common language and body movements to express mathematical content in simple situations.
4	Demonstrate confidence when presenting, expressing, asking questions, discussing, and debating math-related content and ideas.	Show confidence when answering questions, presenting and discussing mathematical content in simple situations.

(Source: General Education Program in Mathematics, 2018)

1.4.3. Forms of mathematical communication by primary school seniors in teaching Maths word problems

According to different concepts on communication, there are also many different forms of communication. However, there is a general consensus of many researchers that communication is mainly expressed through the following four forms: *Communicating by reading; Communicating by listening; Communicating by speaking; Communicating by writing.*

1.5. Teaching Maths word problems in the direction of developing mathematical communication competence for primary school seniors

1.5.1. The role of teaching Maths word problems in developing communication competence for primary school students

In teaching Maths word problems, through mathematical communication activities such as understanding the problem, exchanging with friends and presenting the solution, students learn how to use mathematical language to think, to store information, to convey mathematical ideas, thus making arguments and solving mathematical and practical problems to achieve math learning goals. This process forms, develops and perfects students' mathematical communication competence.

The relationship between mathematical communication competence and solving Maths word problems is the relationship between the whole and the part, between the general and the particular. Solving Maths word problems is only a part of the Maths curriculum at the end of primary school education; however, through the part and the particular, it is possible to form and develop the overall competence, and at the same time, it also relies on the general and the whole competence to solve the problems encountered in each separate part. In summary, the development of mathematical communication competence through teaching Maths word problems solving aims to improve the effectiveness of complete education for children at the end of primary school, prepare them with a solid foundation in both knowledge and skills to prepare for the next level of study.

1.5.2. Levels of assessment of mathematical communication competence of primary school seniors in teaching Maths word problems

We have proposed 5 levels of mathematical communication competence from low to high, which are used to assess the mathematical communication competence of primary school seniors in the research as follows:

Level 0: (The lowest level). At this level, students are often passive, confused in mathematical communication; they have low ability to read - understand, listen - understand about math, or confuse and lack foundation when speaking and writing about math. Students are not able to express their understanding in mathematical language and are afraid to participate in communication.

Level 1: Students can acquire basic mathematical knowledge through mathematical communication activities such as listening to lectures from teachers, reading books or exchanging with friends. Initially, students can present and explain mathematical content in familiar situations with single and discrete sentences. When speaking or writing about a math problem, it is not logical, rigorous, and concise.

Level 2: Students initially take the initiative in mathematical communication activities, understand and use mathematical language in the form of familiar signs and symbols to summarize and present mathematical ideas and solutions to classmates and the teacher in a relatively accurate and appropriate manner.

Level 3: At this level, in addition to absorbing and giving feedback on knowledge in mathematical communication, students know how to find out what they don't know by asking teachers, classmates or searching for information from other sources of information. Students are able to speak or write about mathematical ideas and solutions in a concise and clear manner; analyze, evaluate, and respond to Maths word problems logically and accurately with a confident and respectful attitude.

Level 4: Students actively participate in the process of mathematical communication, present coherently, argue closely, use mathematical language accurately while speaking or writing about math in a convincing and effective manner; make connections or convert natural language to mathematical language and vice versa to accurately represent mathematical objects, relationships or solutions to Maths word problems in a particular context.

1.6. The relationship between mathematical communication competence with some other competencies to be achieved by primary school seniors

1.6.1. Competence to use mathematical language

Language is used as a means to communicate and convey people's thoughts and ideas with each other; language is a means for people to exchange thoughts together, create knowledge and understanding, make people understand each other better. Therefore,

when it comes to mathematical communication, it is impossible not to mention the ability to use language. In the math class, a lot of information is exchanged between the teacher and all students, between the teacher and the individual student, between the individual student and all students, between the individual student and the individual student. The forms of communication that take place in the math classroom are related to the ability to understand and use mathematical language.

1.6.2. Competence to represent mathematics

At the primary level, in the process of learning mathematics, students have been familiarized with and widely used visual mathematical representations (line diagrams, specific objects, images, etc...) to express asscociations, relationships, objects when forming calculations, formulas, in solving Maths word problems or finding two numbers when knowing two conditions. In solving Maths problems, students often have to use symbols, drawings, diagrams, charts, tables, etc. Students can develop and deepen their understanding of concepts and mathematical relationships when creating, comparing, and using different representations. Mathematical representation helps to reduce the abstraction of mathematics, making mathematical formulas and transformations closer to students' perception.

1.6.3. Mathematical modeling competence

Modeling can be understood as one of the bridges of mathematical communication. Mathematical modeling can help students easily understand and grasp difficult and abstract Maths word problems. In addition, mathematical modeling allows students to connect school math to the real world, showing the applicability of math ideas. Modeling provides students with a broader, richer picture of math, makes it easier to convey mathematical information, and helps students see the relationship between math and reality and vice versa.

1.7. The situation of developing mathematical communication competence for primary school seniors

1.7.1. Design and organize surveys

1.7.1.1. Survey objectives

1.7.1.2. Survey contents

1.7.1.3. Survey method and results processing methods: questionnaire; observation method; expert method; satistical methods.

1.7.2. Practical survey results

1.7.2.1. The current state of awareness among administrators and teachers about developing mathematical communication competence

for primary school seniors through teaching Maths word problems solving.

We surveyed the perception of 180 teachers and administrators in 3 primary schools in Lang Son province about the concept of communication; we obtained the results as shown in Table 2.1.

Table 1.1. Perception of teachers and administrators about the concept of communication

Communication concept	Quantity	Percentage %
It is an activity of exchanging information, feelings and thoughts in order to communicate between people.	70	38.9
It is the act of transmitting and processing information.	3	1.7
It is the process of dealing with situations in daily interactions.	22	12.2
It is the process of exchanging information, feelings, thoughts; influence each other in relationships between people to achieve a certain goal.	85	47.2

Based on the survey results presented in Table 2.1, we have the following comments: 47.2% of administrators and teachers have a correct and complete understanding of the concept of communication; 38.9% of administrators and teachers have a correct but incomplete understanding of the concept of communication; The remaining 1.7% of administrators and teachers perceive the concept of communication in favor of skills in communicating and processing information; 12.2% of administrators and teachers perceive the concept of communication as a skill to handle situations in daily interactions.

Through the survey, we found that the majority of administrators and primary school teachers had the correct perception of the concept of communication competence, the meaning of developing communication competence, and the correct identification of important and necessary forms of mathematical communication, which need to be developed for primary school seniors. However, only a part of administrators and primary school teachers understand correctly and fully about mathematical communication competence. Therefore, in order to have more complete comments on this issue, we conducted a survey on the actual situation of developing mathematical communication competence for primary school seniors in teaching Maths word problems solving.

1.7.2.2. The actual situation of developing mathematical communication competence for primary school seniors in teaching

Maths word problems solving

Although many administrators and primary school teachers identify Maths worded problems as a favorable environment to develop mathematical communication competence for primary school seniors, this has not yet been focused on. regularly in the teaching process. Figure 2.2 gives us a clearer view of the above statement:

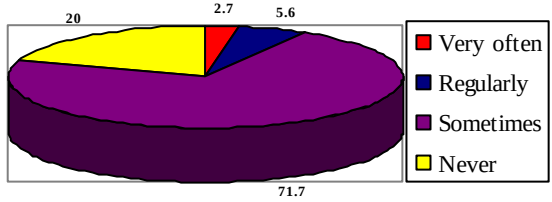

Figure 1.2. How often do teahers and administrators pay attention to developing students' communication competence in teaching Maths word problems

Thus, the percentage of administrators and primary school teachers who are often or very often interested in developing mathematical communication competence for primary school seniors in teaching Maths word problems is still very low at 5.6% and 2.7% respectively.

1.7.2.3. The current situation of students' mathematical communication competence in learning Maths word problems and the difficulties they encounter.

Developing communication skills for students is a shared responsibility of the school, family and society. That educational process requires a close and synchronous coordination between forces in society, creating an educational environment in general, developing mathematical communication competence in particular in a healthy and great synergy. However, in order to do that, teachers need to receive the active cooperation of students' parents in the educational process.

1.7.3. General assessment of the status of developing communication competence for primary school students in teaching Maths word problems

In general, administrators and teachers of the final grades of primary school have been aware of the importance and significance of developing mathematical communication competence for primary

school seniors. However, some contents are still not fully understood by administrators and teachers in educational activities.

The issue of developing mathematical communication competence for primary school seniors has been implemented and has certain results. Through the survey, it was found that the main and basic skills of mathematical communication have achieved certain results. At a more prominent level, the skills of listening comprehension, reading comprehension or self-confidence have been paid attention to during school hours and extra-curricular activities, so certain results have been achieved. However, there are still limitations that need to be further concerned and overcome.

In addition, primary school seniors, due to their limited mathematical language skills and low thinking ability, are limited in their skills in presenting and expressing Maths word problems and using mathematical language with high efficiency.

The shortcomings in this performance result are also easy to explain because they are directly influenced by the circumstances, the environment and even the communication subjects themselves. To overcome these shortcomings and in order to achieve higher results, educators must take effective measures to develop communication competence for students in the last grades of primary school.

Conclusion for chapter 1

We approached the mathematical communication competence of primary school seniors in teaching Maths word problems solving according to the four manifestions indicated in *the General Education Program in Mathematics* of the Ministry of Education and evaluate these manifestions on five levels from low to high.

We also conducted a survey for students in grades 4 and 5 in a number of primary schools in urban, rural and mountainous areas. Thereby, we found that students did not understand well about mathematical communication, they did not pay attention to the problem of expressing mathematical knowledge in communication forms. Especially for students in rural and mountainous areas, many of them are shy and don't know how to express their views on a math problem.

The above results are an important premise for us to propose pedagogical measures in chapter 2.

Chapter 2. MEASURES TO DEVELOP MATHEMATICAL COMMUNICATION COMPETENCE FOR PRIMARY SCHOOL SENIORS IN TEACHING MATHS WORD PROBLEMS

2.1. Orientations for proposing measures to develop mathematical communication competence for primary school seniors through teaching Maths word problems solving

2.1.1. Orientation 1: Measures to develop mathematical communication competence for students need to match cognitive characteristics of primary school seniors.

2.1.2. Orientation 2: Measures to develop mathematical communication competence must be implemented regularly in each math lesson.

2.1.3. Orientation 3: Measures must be taken to ensure the achievement of the goal of teaching mathematics and towards the development of students' mathematical communication competence.

2.1.4. Orientation 4: The proposed measures must exploit students' existing mathematical knowledge and life experience.

2.2. Some measures to develop mathematical communication competence for primary school seniors through teaching c solving

2.2.1. Measure 1: Develop skills in listening, reading and recording mathematical information in the problem through problem-study activities

2.2.2. Measure 2: Develeop students’ skills in presenting and expressing mathematical contents and ideas through activities of finding solutions and presenting solutions.

2.2.3. Measure 3: Develeop students’ skills in using natural language effectively combined with mathematical language when presenting, explaining and evaluating mathematical ideas through problem-reviewing activities.

2.2.4. Measure 4: Organize diverse forms of communication for students to build confidence when presenting and expressing mathematical content.

Conclusion for chapter 2

On the basis of the theoretical and practical research on mathematical communication in Chapter 1 and the actual situation of the mathematical communication competence of primary school seniors in teaching and learning activities with math word problems, in Chapter 2 we have stated the concept, level and orientations for the

development of mathematical communication competence for students; Accordingly, four measures have been proposed to develop mathematical communication competence in teaching Maths word problems solving in grade 4 and 5; at the same time, we have researched and implemented the application of measures to develop mathematical communication competence in teaching Maths word problems solving in grade 4 and 5.

The feasibility of these measures will be shown in the results of the organization of pedagogical experiments in Chapter 3.

Chapter 3. PEDAGOGICAL EXPERIMENT

3.1. Experiment purposes

3.2. The process of organizing pedagogical experiments

The thesis organizes pedagogical experiments according to the following process:

1. Use expert method to consult scientists; university lecturers who are training primary school teachers; and teachers who are directly teaching in primary schools about the levels of assessing mathematical communication competence of primary school seniors and about the pedagogical measures proposed in the thesis to develop mathematical communication competence for primary school seniors in teaching Maths word problems solving. The results of consulting experts are analyzed by the researcher and serve as a basis for adjusting the pedagogical methods before being tested.

2. The researcher selected pedagogical experimental samples which are representative samples, using appropriate research methods such as observation method, case study method, mathematical statistical method for analyzing and proving the validity of the scientific hypothesis.

The process of pedagogical experiment is carried out through the following steps: building the level of evaluating pedagogical experimental results; selecting experimental methods; determining experimental content, collecting and evaluating experimental results.

3.3. Methods of evaluating pedagogical experiment results

3.4. Pedagogical experiment contents

3.4.1. Pedagogical experiment documents

3.4.2. The procedure of conducting pedagogical experiment

The pedagogical experiment was conducted in two stages as follows:

3.4.2.1. Phase 1: initial experimentation of research results

3.4.2.2. Phase 2: conduct the experiment on 6 classes in 3 primary schools in Thai Nguyen and Lang Son provinces.

3.5. The process of the pedagogical experimentn and the results obtained

3.5.1. Experiment phase 1

3.5.1.1. Time, location and sampling for the pedagogical experiment phase 1

- Time: From February 2018 to June 2018.

- Location: Huu Lien Primary School, Huu Lung District, Lang Son Province.

- Select a pedagogical experiment sample: We discussed with the Board of Directors and the teachers in the specialized group of grade 4 to gather information, and selected the experimental sample for the two classes of equal qualifications. Specific information is as follows:

Experimental class and control class	Class	Number of students	Teacher's full name	Qualifications	Number of years of teaching	Title of good teacher
Experimental class	4 A	30	Lan Quoc Tuan	Pedagogical College - Primary education	18	District level
Control class	4 B	31	Hoang Thi Thoai	Pedagogical College - Primary education	16	District level

3.5.1.2. Results of the experiment phase 1:

After organizing teaching and administering the assessment tests, the experiment phase 1 obtained the following results:

a. Qualitative assessment results

Through observing the learning process of students and exchanging ideas, collecting opinions from administrators, teachers and students in two experimental and control classes, we found that:

- Experimental class students made progress in mathematical communication activities; they identified problems faster and find the corresponding solution. Meanwhile, many students of the control class have not yet identified the problem, and are still confused in changing the unit of uniformity between the given data.

- Experimental class students already knew how to create a new math problem, but they could only do it at the level of easy math

problems, and only replaced the data or objects in the problem. Students in the control class, when creating a new math problem, did not know how to consider the relationship between the new data (for example, when changing pairs of numbers that are not divisible by each other in a division problem) or when they changed the object, they did not know how to change the data to suit the object (for example, buying a book is replaced by buying a car but keeping the price at 7 thousand VND).

- Experimental class students made fewer mistakes than control class students while performing G. Polya's 4-step word problem-solving process. Experimental class students had some difficulties in the second step to find the solution to the problem. Most of the control class students did not complete the process (in step 1, they did not specify keywords; most did not perform step 4).

- Experimental class students are more brave in participating in mathematical communication activities such as group discussions, debates with classmates or asking questions to classmates or teachers about problems they do not understand in the math problem.

b. Quantitative assessment results:

Table 3.2. Results of the experimental and control class in the experiment phase 1

x_i	Total number of students	Score 3	Score 4	Score 5	Score 6	Score 7	Score 8	Score 9	Score 10	Average score
$n_{i\ (Experiment)}$	30	0	0	2	3	6	9	7	3	7,83
$n_{i\ (Control)}$	31	1	1	3	7	8	6	5	0	6,87

Table 3.3. Statistical processing results of experimental and control classes in phase 1

Scores	Experimental class		Control class	
	Occurrence frequency	Total scores	Occurrence frequency	Total score
3	0	0	1	3
4	0	0	1	4
5	2	10	3	15
6	3	18	7	42
7	6	42	8	56
8	9	72	6	48
9	7	63	5	45
10	3	30	0	0
Total	30	235	31	723
Sample Mean	$\overline{X}$ = 7,83		$\overline{X}$ = 6,87	

Scores	Experimental class		Control class	
	Occurrence frequency	Total scores	Occurrence frequency	Total score
Sample Variance	$S_{TN}^2 = 1,81$		$S_{ĐC}^2 = 2,24$	
Standard Deviation	$S_{TN} = 1,34$		$S_{ĐC} = 1,50$	

+ Test of variance by hypothesis E_0 "The difference between the variances in the experimental class and control class is not significant" with the quantity $F = \frac{S_{TN}^2}{S_{DC}^2}$

Degree of Freedom		Quantity $F = \frac{S_{TN}^2}{S_{DC}^2}$	F α	Compare F and F α
$f_{experiment}$	$f_{control}$			
30	31	0,808	1,697	F < F α

Since F < F α , we accept the hypothesis $E_{0,}$ that is the difference between the variances in the experimental and control class groups is not significant, thus testing the hypothesis H_0 "The difference between the mean score in the two samples is not significant with the same variance", we get the following statistic:

Degree of Freedom ($N_{experiment} + N_{control} - 2$)	Quantity $t = \frac{\overline{X_{TN}} - \overline{X_{DC}}}{\sqrt{\frac{S_{TN}^2}{n_{TN}} + \frac{S_{DC}^2}{n_{DC}}}}$	t α	Compare t and t α
59	2.88	1,671	t > t α

Because t > t α , the H_0 hypothesis is rejected. This proves that the difference between the mean scores in the two samples is significant, showing that the learning outcomes of the experimental group are higher than those of the control group.

Thus, the experimental results of phase 1 initially help us confirm that the pedagogical measures which have been built do help develop the mathematical communication competence of primary school seniors in teaching Maths word problems, which contributes to improving the quality of students' math learning.

3.5.2. Experiment phase 2

3.5.2.1. Time, location and sampling for pedagogical experiment phase 2

- Time: From August 2018 to March 2019.

- Location: the experiment was conducted at 3 primary schools: Huu Lien commune primary school, Son Ha commune primary school (Huu Lung, Lang Son) and Nguyen Viet Xuan primary school (Thai Nguyen city).

- Select the pedagogical experimental sample: We discussed with the Board of Directors and the teachers in the specialized group of grade 4 to gather information, and select the experimental sample for the corresponding classes of equal qualifications.

3.5.2.2. Results of the experiment phase 2:

** Grade 4 (statistics by test questions)*

The test results obtained after conducting the experiment show that students of the experimental class have better results than students of the control class, specifically in the questions ietms listed follows:

Question 1: Test reading and writing skills of multi-digit natural numbers: students in the experimental classes did better than students in the control classes

+ Most of the students in the experimental classes read and wrote correctly and when reading and writing natural numbers, students knew how to separate numbers into classes and rows for easy reading.

+ In the control classes, some students did not know how to separate the number into classes of one letter to read. When writing numbers that are separated by class, students knew how to read, otherwise students were confused. There are many students who recorded the wrong reading; for example, 945 468 read as “nine four five four six eight”; or wrote down the wrong reading: "nine, four, five, four, six, eight",...

Question 2: The experimental classes also have higher results than the control classes

Students of experimental and control classes when performing calculations, there are usually two ways of asking: Way 1, the requirement only states: "Calculate"; Way 2, the requirement states: "Set the calculation and then calculate". In practice, we see that in the second way of asking the students could get higher results.

Question 3: We could see that students in the experimental classes have higher results than students in the control classes

+ Students in experimental classes know how to convert from natural language to mathematical language faster and more accurately. Most students understand the terms and know how to set up calculations to calculate the “sum”, “difference”, “product”, “quotient” of the first and second fractions. They set the caculation right, wrote it right and most of the time they could calculate the correct result.

+ In the control classes, some students did not know how to

write calculations to calculate; write fractions incorrectly, write sloppily the signs “minus”, “addition”, “multiply”, “divide”. They often wrote the signs in the wrong place and made many mistakes in caculation.

Question 4: It is confirmed that students in the experimental classes communicate much better in math than students in the control classes

+ Students of experimental classes mostly drew summary diagrams with straight lines; presented the solution quite clearly; the solution and the appropriate calculation were concise and accurate; they knew how to write the correct answer.

+ Some students in the control classes did not know how to summarize the problem with a line diagram; the solution and the calculation were not suitable, the answer was still wrong.

** Grade 5 (statistics by test questions)*

The test results obtained after conducting the experiment show that students of the experimental classes have better results than students of the control class, specifically in the questions ietms listed follows:

Question 1: To test the skills of reading and writing decimal and mixed numbers with measurement units. Students in the experimental classes did better than students in the control classes:

+ In experimental classes, most students knew how to read and write quite fluently decimals, fractions and mixed numbers; especially those numbers are accompanied by units of measurement in square centimeters, millimeters, kilograms, etc.

+ Students in the control classes made a lot of mistakes when reading mixed numbers and units of measure. In general, students did not write down how to read numbers with units of measurement attached; instead, they recorded how to read in symbols brand.

Question 2: Test the skills of calculation and syntax for performing calculations with time units. Students in the experimental classes had better results than students in the control classes:

+ Most of the students in the experimental classes have quite proficient skills in calculating and converting units of measurement.

+ Some students in the control classes were still confused in setting calculations with measurement units, or changing units of measurement; they even misrepresented the syntax.

Question 3: It can be seen that the students' ability to convert

natural language from real situations to mathematical language is better than that of the control classes.

+ Most of the students in the experimental classes knew how to read and understand the diagram, from which the percentage of students with good academic performance can be determined: 100% - 20% - 15% = 65%. This is the core problem to calculate the number of students in each category of good, fair, and average as shown in the figure (Appendix 3).

+ Some students in the control classes did not understand that the whole circle in the above chart is 1 unit, ie 100%, so they could caculate the percentage of students who are quite good at 65%.

Question 4: In general, students in the experimental classes had communication skills, as well as math problem solving skills, and they could apply mathematics into practice faster and more sensitively than students in the control classes.

+ Most of the students in the experimental classes could read and understand the problem and identify the key words of the problem.

+ Some students in the control classes did not have the skills to identify keywords of the problem, did not understand the natural language in the problem, so they could not deduce how to calculate the volume of the tank; Many students were confused in calculating the height of the tank.

3.5.2.3. Results of analysing the development of students' mathematical communication competence in teaching Maths word problems solving through case study.

During the pedagogical experiment, we paid special attention to 3 selected students; regularly monitored their learning process in the lessons before, during and after the experiment; observed the mathematical communication manifestions of the 3 students above; collected and recorded their manifestions. During the experiment, besides classroom hours, we also met the three students to exchange, share and give direct suggestions to those students. During the math problem solving process, we also asked questions and asked them to answer or comment on their peers more than other students. At the same time, we also paid more attention to the test paper of these 3 selected students to analyze in-depth the development of manifestations of mathematical communication competence in math word problem solving activities.

3.5.3. General results of the pedagogical experiment

a) For teachers

+ Through the experimental process, we see that there have been many changes in the innovation of teaching methods in the direction of developing mathematical communication competence in teaching Maths word problems. The shortcomings of teachers before the experiment were generally overcome.

+ Teachers have had a sense of self-training, refinement, and correct use of mathematical language and language in mathematical communication.

+ Teachers have often paid attention to measures to develop mathematical communication competence in teaching Maths word problems for students in teaching Mathematics.

b) For students

- Students have consciously accumulated mathematical vocabulary in a systematic way, understood and correctly use mathematical symbols and visual models to represent mathematical content; step by step get in the habit of studying theory before doing exercises.

- Students have absorbed mathematical information as well as presented and expressed mathematical content more accurately.

- The ability to convert natural language to mathematical language and vice versa has many improvements.

- Initially, students already know how to reason when performing mathematical thinking manipulations.

Conclusion for chapter 3

Through the process of pedagogical experimentation, with the results obtained after the experiment we can conclude that:

- Teachers' perception of teaching and learning mathematical communication has been changed; teachers have paid more attention to developing mathematical communication competence in teaching Mathematics for students and for themselves. The quality of teaching communication in mathematics and teaching mathematics has changed markedly.

- Mathematical communication competence has been formed and trained in a scientific and sequential manner: from simple to complex, from low to high corresponding to the students' mathematical communication levels. Therefore, students have a solid theoretical foundation on mathematical communication; their

communication skills have seen positive changes in speaking, writing, presenting and expressing a problem in Math as well as a problem in real life. These changes really contributed to improving the quality of teaching Mathematics. Characteristic elements of mathematical communication were also initially formed and developed.

We can affirm the suitability, feasibility, and effectiveness of the measures proposed by the thesis. These measures can be deployed and applied in teaching and learning to develop mathematical communication competence in teaching Maths word problems in grade 4 and 5 at primary school.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusion

Through the research process, the thesis has obtained the following results:

1.1. The thesis has systematically mentioned and contributed to clarifying a number of theoretical issues about mathematical communication competence in general and mathematical communication competence of primary school seniors in particular in teaching Maths word problems.

1.2. The thesis has built 5 levels of mathematical communication competence in teaching Maths word problems of primary school students based on 4 corresponding manifestations of mathematical communication competence mentioned in the new Maths program of the Ministry of Education.

1.3. A survey and analysis have been conducted to determine the current situation of the problem of developing mathematical communication competence for primary school seniors in teaching Maths word problems solving.

1.4. On the basis of theoretical and practical research results, the thesis has clarified the orientations of building pedagogical measures. Accordingly, four specific pedagogical measures are proposed to contribute to the development of mathematical communication competence for primary school seniors in teaching Maths word problems.

1.5. The pedagogical measures have been tested in 2 phases.

1.6. Five articles have been published in prestigious specialized journals; the content of the articles has a close relationship with the content of the thesis.

The above results have initially proved that the pedagogical

methods proposed by the author are completely feasible to implement in math lessons for primary school seniors. The thesis has achieved the research objectives set out; the scientific hypothesis is acceptable; the research topic is feasible and can be deployed in teaching mathematics at primary school.

2. Recommendations

2.1. For pedagogical universities and pedagogical colleges with specialized training courses in primary education: It is necessary to raise awareness for students of primary education about mathematical communication competence in general and mathematical communication competence in teaching Maths word problems in particular, contributing to improving the quality of math teaching.

2.2. For primary school administrators: They should create conditions for teachers to participate in training sessions, seminars on mathematical communication, and raise awareness and quality of mathematical communication for teachers themselves. These are conditions for training and developing mathematical communication competence for students.

2.3. For primary school teachers: It is necessary to invest effort and time to design and develop lesson plans that integrate content to develop students' mathematical communication competence, creating a favorable environment during class time and create opportunities for children to participate in mathematical communication and promote their mathematical communication competence, thereby developing mathematical communication competence for students in particular and improving the quality of math teaching in general.