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TEACHING NUMBER AND OPERATIONS IN GRADE 5 TOWARDS DEVELOPING MATHEMATICAL PROBLEM-SOLVING COMPETENCE

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ABSTRACT

This paper focuses on studying and proposing measures to innovate the teaching methods of the “Number and Operations” content for Grade 5 students in order to meet the requirements of developing mathematical problem-solving competence. The article affirms that competence is not merely the accumulation of knowledge but the integrated mobilization of skills, attitudes, and experiences to effectively handle real-life situations. On that basis, the study proposes a teaching process consisting of four steps: from creating problem-based situations rich in practical context, exploring solutions, presenting ideas, to evaluating and generalizing new knowledge. Through specific illustrative examples such as rounding decimal numbers or adding two decimal numbers, the article demonstrates that connecting mathematics with everyday activities helps students transition from passive reception to active knowledge construction. The research results not only contribute to systematizing the theoretical foundation of competence-based teaching but also provide a practical action framework for primary school teachers in teaching Mathematics.

KEYWORDS: Mathematics Education; Primary Mathematics; Number and Operations; Competence; Mathematical Problem Solving

INTRODUCTION

The General Education Curriculum in general, and the mathematics curriculum in particular, has identified the objective of shifting the focus from knowledge transmission to the development of learners’ competencies and qualities. Among these, mathematical problem-solving competence is considered one of the five component competencies of mathematical competence. Mathematical problem-solving competence not only helps students deepen their mathematical knowledge and skills but also enables them to mobilize integrated knowledge and skills to handle real-life situations.

Therefore, researching and proposing a process for designing introductory activities and new knowledge formation activities in teaching the “Number and Operations” content in Grade 5 is necessary and holds both theoretical and practical significance. Through the construction of problem-

based situations rich in real-life context, the study aims to optimize students' ability to explore, discover, and affirm the value of mathematics in daily life.

CONTENT

1. Competence-based teaching

Competence is defined as “an individual attribute formed and developed through innate qualities and the process of learning and training, enabling a person to mobilize a combination of knowledge, skills, and other personal attributes such as interest, belief, will, etc., to successfully perform a certain type of activity and achieve desired results under specific conditions” [1]. Thus, competence is not merely knowledge or isolated skills but an integration of knowledge, skills, attitudes, and experiences to effectively perform learning tasks and real-life activities.

From this perspective, according to the General Education Curriculum, competence consists of three fundamental components:

Knowledge: the cognitive foundation that helps individuals understand and correctly analyze the nature of objects and tasks in activities.

Skills: the ability to perform, operate, think, or apply knowledge in specific situations.

Qualities, attitudes, and other personal factors: internal motivations that create proactiveness, responsibility, resilience, and value orientation of learners during task performance.

Competence-based teaching emphasizes [5]:

- Competence is only formed through activities. Therefore, students must learn and practice through and by activities. Competencies are formed not only in school but also under the influence of family, society, politics, religion, and culture.

- It focuses on each individual student, helping them explore, discover, master knowledge, and apply it to solve real-life situations, thereby drawing their own experiences and knowledge.

- It emphasizes learning outcomes based on what learners can do after completing a program or lesson, highlighting students' actual abilities.

It emphasizes the learner-centered approach and is built upon various learning theories such as behaviorism, activity theory, and constructivism.

- It highlights learning methods and self-learning. Instead of traditional teacher-centered instruction, it organizes individual learning, group learning, and learning based on interests and personal needs.

- Teachers act as facilitators and designers, while students construct their own knowledge and understanding. Therefore, the learning environment must promote positive interaction among students and between teachers and students, fostering observation, exploration, discovery, and creativity.

- It encourages the application of technology and teaching equipment to optimize the development of learners' competencies.

2. MATHEMATICAL PROBLEM-SOLVING COMPETENCE

In the primary Mathematics curriculum, mathematical problem-solving competence is identified as one of the core competencies that need to be formed and developed in students. According to the Mathematics curriculum [2], this competence is understood as the ability to identify, formulate, and solve problems related to mathematics or to use mathematics to solve real-life problems appropriate to students' level. This competence includes the following specific criteria:

- Identifying and recognizing problems that need to be solved mathematically.
- Proposing and selecting appropriate methods and solutions.
- Using relevant mathematical knowledge and skills (including tools and algorithms) to solve the problem.
- Evaluating the solution and generalizing it for similar problems.

Example. Fill in the blanks:

a) $8.9 + \dots = 28.501$; b) $\dots + 8.16 = 17.5$; c) $\dots - 6.17 = 11.83$

Opportunities to develop mathematical problem-solving competence are reflected through the following processes:

- Observing and recognizing the problem situation: finding the unknown number in addition or subtraction with decimals.
- Selecting a solution method: determining the missing component and applying calculation rules to find the required number.
- Solving the problem: calculating the missing number to fill in the blanks.

a) $8.9 + 19.601 = 28.501$; b) $9.34 + 8.16 = 17.5$; c) $18 - 6.17 = 11.83$

- Writing (presenting) the result in the blank.
- Checking the result: students substitute the found number back into the original expression to verify correctness.

3. Teaching Number and Operations in Grade 5 towards developing mathematical problem-solving competence

3.1. Principles for teaching Number and Operations in the direction of developing mathematical problem-solving competence for Grade 5 students

a) Ensuring compliance with the theory and methodology of teaching Mathematics at the primary level

In designing instructional activities for the “Number and Operations” content, adherence to the theory and methodology of primary Mathematics teaching is a fundamental requirement. Teaching activities must be designed not only to provide knowledge and computational skills but also to create conditions for students to understand the nature of knowledge and apply it to diverse situations in learning and life.

b) Creating opportunities to develop students’ mathematical problem-solving competence

One of the important orientations in current teaching is the development of competencies in general and mathematical problem-solving competence in particular. Therefore, when designing instructional activities for Number and Operations, teachers need to create learning situations associated with real-life contexts. These situations both ensure that students apply mathematical knowledge and help them recognize the significance of mathematics in daily life.

c) Designing activities that ensure appropriateness and suitability to students’ psychological characteristics

Mathematics at the primary level is considered foundational, helping students form basic knowledge, skills, and develop mathematical competence. Ensuring appropriateness is therefore an important principle. When teaching Number and Operations, teachers should adopt approaches from simple to complex, from familiar to abstract.

d) Ensuring the feasibility of activities in practical teaching contexts

When designing instructional activities for Number and Operations, feasibility must be ensured. Learning activities should not remain at the level of ideas or theory but must be implementable under real teaching conditions in primary schools. This requires consideration of factors such as facilities, lesson duration, teachers’ qualifications, and students’ cognitive levels.

3.2. Teaching Number and Operations in the direction of developing mathematical problem-solving competence for Grade 5 students

3.2.1. Designing introductory activities associated with real-life contexts

a) Objectives

To help students:

- Develop interest in learning content through familiar real-life situations.
- Recognize the necessity of learning decimal numbers and operations with decimals to solve real-life situations.
- Focus attention, actively participate in lessons, and initially form problem-identification competence.

b) Implementation process

Step 1. Study the expected learning outcomes and outline a problem-based situation.

Teachers need to base their design directly on the expected learning outcomes and specific lesson objectives. From there, they analyze the new knowledge content to determine whether students need to understand a concept, rule, or skill. Then, they outline appropriate problem-based situations closely aligned with the knowledge requirements. These situations must be “open” so that students can raise questions or doubts, thereby stimulating interest and facilitating knowledge acquisition. If the situation is too closed, students will only receive information without forming the need to explore. Therefore, teachers must both adhere to curriculum requirements and be creative in selecting real-life elements for the situation.

Step 2. Design the problem-based situation.

After outlining the situation, teachers need to concretize it through context, dialogue, or data familiar to primary students. Selecting real-life situations is crucial because it helps students see the usefulness of mathematics in daily life. For example, situations can be related to buying and selling, measurement, weight, height, etc., which are familiar experiences. Besides familiarity, the situation must contain a “problem-triggering” element that makes students ask: why is it like this? is there a more reasonable way? This is the point that stimulates thinking and leads to the need to learn new knowledge. If the situation is merely illustrative, students will find it difficult to develop problem-solving competence.

Step 3. Design introductory activities associated with the problem-based situation.

Based on the designed real-life situation, teachers organize introductory activities appropriate to the context. Students directly participate in recognizing the situation, identifying problems, and proposing solutions. During this process, teachers do not immediately provide answers but encourage students to propose hypotheses, make observations, and even express initial misconceptions. This allows teachers to assess students’ understanding and create a foundation for introducing new content. Thus, the introductory activity not only initiates the learning atmosphere but also helps students recognize the necessity of learning subsequent knowledge.

c) Notes

- The introductory situation should be concise and clear, avoiding excessive complexity that may distract students.
- Priority should be given to familiar real-life situations such as measuring height, weight, buying and selling, and time calculation.
- Activities should create opportunities for students to think, discuss, and express opinions rather than receiving immediate answers from the teacher.
- Teachers should anticipate different student responses to provide timely guidance and scaffolding.

d) Illustrative example

Example 1. Designing an introductory activity for teaching “Rounding decimal numbers to the nearest whole number.”

Step 1. Study the expected learning outcomes and outline the problem-based situation.

The expected learning outcome in the Grade 5 Mathematics curriculum regarding rounding decimals is: “Round a decimal number to the nearest whole number or to a decimal number with one or two decimal places.”

Proposed situation: Select familiar, everyday situations related to primary students’ activities such as measuring height or weight of themselves or their peers. These quantities are often expressed as decimal numbers and are commonly encountered through periodic health check-ups at school or medical examinations.

Step 2. Designing the problem-based situation



The situation is designed within the context of a periodic health check at a primary school, where students take turns measuring their body weight. The recorded weights are typically expressed as decimal numbers; however, when reading the results, the doctor rounds each student’s weight to the nearest whole number. This setting enables students to raise the question of why the doctor reports the results in such a way and to seek an explanation.

Step 3. Designing the introductory activity associated with the problem-based situation

Based on the designed real-life situation, the teacher organizes an introductory activity appropriate to the context:

- Organize individual activity: students observe the picture and think about describing the situation presented.
- Organize group activity (groups of four): the teacher assigns roles including two students, one doctor, and one robot to reenact the situation.
- Organize problem identification: the teacher poses the question: “Why does the doctor not record the exact weight but instead writes it as a whole number? Can you guess what rule the doctor used?” Students discuss, express their thoughts, and make initial predictions.
- The teacher concludes and leads into the lesson: “In practice, we do not always need to state numbers with full decimal precision; instead, we often use approximate values in the form of whole numbers. To do this, we need to know how to round decimal numbers to the nearest whole number. Today’s lesson will help you learn how to do that.”

3.2.2. Designing instructional activities for forming new knowledge towards developing mathematical problem-solving competence

a) Objectives

To help students:

- Identify and define mathematical problems from specific situations, thereby mobilizing prior knowledge and skills to seek solutions to new problems.
- Propose multiple solution strategies, experiment with different approaches, and compare and select appropriate ones.
- Generalize into new knowledge and rules, and be able to apply newly discovered knowledge to similar or more advanced situations.

b) Implementation process

Step 1. Creating a problem-based situation

The teacher designs and presents a real-life or mathematical situation that is familiar and closely related to students’ daily experiences. The situation must be engaging, containing elements of novelty or an appropriate level of challenge to stimulate students’ curiosity and exploration. Through observing, listening, and reflecting on the situation, students recognize that there is a mathematical requirement to be addressed. This is a crucial starting point that helps form learning motivation and creates a natural “bridge” to new knowledge.

Step 2. Exploring solutions to the problem

After identifying the problem, students are encouraged to mobilize their prior knowledge, understanding, and learned skills to propose possible solutions. At this stage, students may generate various approaches, ranging from intuitive ideas to more reasoned arguments. The process of discussion and exchange within groups or across the whole class not only diversifies ideas but also fosters critical thinking, enabling students to analyze and evaluate solutions from multiple perspectives. The teacher acts as a facilitator, observing and guiding through probing questions rather than providing ready-made answers, thereby encouraging independent inquiry.

Step 3. Presenting solutions

Once a solution path has been identified, students present their methods. Presentation can take various forms, such as verbal explanation, written calculations, schematic representation, or a combination of these. This stage provides an opportunity to develop mathematical communication competence, helping students practice clear and coherent expression as well as defend their viewpoints. Other students observe, compare, and provide feedback, gradually clarifying the overall solution.

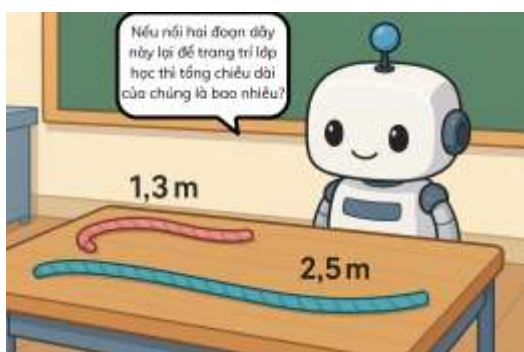
Step 4. Evaluating solutions and discovering new knowledge

In the final step, students and the teacher collaboratively analyze, compare, and evaluate the appropriateness and accuracy of the proposed solutions. Through this process, students recognize the underlying nature of the mathematical problem and gradually identify general patterns and characteristics in the methods used. Based on this, students may formulate conjectures about new rules. The teacher then synthesizes, generalizes, and formalizes these conjectures into standard knowledge, while emphasizing the significance of the new knowledge in solving similar situations in both learning and real life. Finally, students reflect on the entire process, draw conclusions, and consolidate the acquired knowledge

c) Illustrative example

Designing a knowledge discovery activity for teaching the content “Addition of two decimal numbers.”

Step 1: Creating a problem-based situation to help students identify the mathematical problem



The teacher presents a familiar real-life situation: On the table, there are two silk ribbons, one pink ribbon measuring 1.3 meters and one blue ribbon measuring 2.5 meters. This situation is both closely related to everyday experiences of primary school students and contains a mathematical requirement to be solved, thereby stimulating students' interest and cognitive demand.

Through analyzing the situation, students realize that to answer the teacher's question, they must calculate the total length of the two ribbons. They identify the need to perform the addition of two decimal numbers: $1.3 + 2.5$. Thus, students have identified the mathematical problem to be solved, namely how to perform the addition of two decimal numbers.

Step 2: Exploring solutions to the problem

After identifying the mathematical problem, students begin to think about possible solution methods. However, since they have not yet learned the rule for adding decimal numbers, they cannot directly apply it and must rely on prior knowledge to determine the result. In this situation, the teacher encourages students to mobilize their existing knowledge, specifically the addition of natural numbers, to find a solution. During group discussions, students propose converting measurement units to transform the addition of decimal numbers into the addition of natural numbers. Their approach is as follows:

- Convert measurements from meters to centimeters or decimeters to obtain whole numbers.
- Perform the addition of natural numbers.
- Convert the result back to meters.

Thus, students successfully solve the given situation by applying prior knowledge. At the same time, they recognize that with flexible thinking, they can solve new problems, thereby building confidence in their own abilities.

Step 3: Presenting the solution

- Students are invited to present their group or individual solutions on the board. They clearly explain their approach:

Convert: $1.3 \text{ m} = 130 \text{ cm}$ and $2.5 \text{ m} = 250 \text{ cm}$.

Perform the addition: $130 + 250 = 380 \text{ (cm)}$.

Convert back to meters: $380 \text{ cm} = 3.8 \text{ m}$.

Through applying previously learned knowledge, students find a solution in an indirect way (converting to natural numbers before performing addition). This process not only helps them solve the mathematical problem but also provides an initial understanding of the nature of decimal addition, laying the foundation for acquiring the formal rule in a natural and meaningful way.

Step 4: Evaluating the solution and discovering new knowledge

- The teacher listens to the presentations and provides feedback.

- The teacher poses guiding questions to lead students toward discovering the rule for adding decimal numbers.
- The teacher presents the calculation in column form to facilitate observation and asks students to examine how digits are aligned, thereby identifying patterns in decimal addition.
- Students observe: “Digits in the whole-number part are aligned vertically; digits in the decimal part are also aligned; importantly, the decimal points are placed in the same column.”
- The teacher asks students to formulate a rule: based on observation and analysis, students initially conclude that when adding two decimal numbers, the numbers should be written so that the decimal points are aligned, then addition is performed as with natural numbers.
- The teacher formalizes the rule: To add two decimal numbers:
 - + Write the numbers so that digits in the same place value are aligned vertically.
 - + Add as in the addition of natural numbers.
 - + Place the decimal point in the sum aligned with the decimal points of the addends.
- Students evaluate the solution: after comparison, they recognize that performing decimal addition directly in column form is faster, more concise, and more efficient than the initial method (unit conversion). They understand that this is the standard and effective method to be used in subsequent problems.

CONCLUSION

Through theoretical analysis and the proposal of specific illustrative examples, the study affirms that teaching the “Number and Operations” content in Grade 5 towards developing mathematical problem-solving competence is both a necessary and effective approach. The results show that when instructional activities are designed based on the principles of appropriateness, feasibility, and real-life relevance, students no longer passively receive mathematical rules. Instead, through the four-step process from problem creation to solution evaluation, learners are given opportunities to identify problems independently, propose creative solutions, and generalize new knowledge. The study contributes to improving the effectiveness of Mathematics teaching in general, and the teaching of Number and Operations in Grade 5 in particular, within the framework of competence-based education.

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