

## Teaching Decimal Operations to Develop Mathematical Thinking and Reasoning Competency for Primary School Students in Vietnam



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**ABSTRACT:** Vietnam is in the process of comprehensively reforming education. In 2018, the Vietnamese Ministry of Education and Training issued the General Education Program. In addition to general competencies, the 2018 General Education Program also aims to develop specific competencies for students, including mathematical competency. Mathematical competency includes 5 component competencies: mathematical thinking and reasoning; mathematical modeling competency; mathematical problem solving competency; mathematical communication competency; competency in using mathematical tools and means. This article presents some measures to develop mathematical thinking and reasoning competency for 5th grade students through teaching the content of calculations with decimals in primary school. These are also some suggestions for managers and teachers of primary schools in Vietnam to improve the quality of teaching Mathematics in general.

**KEYWORDS:** Math, Ability, Mathematical Thinking and Reasoning Competency, Calculations with Decimals, Primary School.

### I. INTRODUCTION

Edward de Bono (1985) is a master scientist of thinking with the theory of "thinking of thinking", he developed concepts and clarified the relationship between intelligence and thinking skills. In the work "Six Thinking Hats" the author presented creative thinking methods to improve reasoning and problem-solving skills

Theoretical research on thinking and reasoning focuses on identifying and classifying forms of thinking and reasoning, as well as factors that influence this process. Many researchers such as Robert Ennis and Richard Paul have contributed to the development of theoretical frameworks on critical thinking, focusing on analyzing, evaluating and constructing arguments based on evidence and logical reasoning. Studies by Jean Piaget and Lev Vygotsky explored the development of logical thinking from childhood to adulthood, emphasizing the role of language and social interaction in the development of reasoning.

Applied research in education focuses on developing and testing teaching methods to improve students' thinking and reasoning abilities. Educational programs such as Philosophy for Children (P4C) and Project Zero at the Harvard Graduate School of Education aim to promote critical thinking through questioning, group discussion, and analysis of complex issues. Many studies have shown that teaching science and mathematics with a focus on logical reasoning and problem solving can improve students' thinking abilities.

The Vietnamese government considers education a top national policy. The current direction of innovation in Vietnamese education is: "Developing education and training to improve people's knowledge, training human resources, and nurturing talents. Strongly shifting the educational process from mainly equipping knowledge to comprehensively developing learners' abilities and qualities". This innovation direction has been bringing positive changes in current educational activities.

Thinking and reasoning ability is one of the important skills that help individuals solve problems, make effective decisions and develop their careers. The school year 2024-2025 is the year that begins implementing the General Education Program for grade 5. Developing mathematical thinking and reasoning ability is one of the important goals. In the learning content of Numbers and Calculations for grade 5, the topic of decimals is difficult because students initially get acquainted with performing calculations on new sets of numbers based on inheriting calculations with sets of numbers they have learned (natural numbers, fractions). On the other hand, for the topic of calculations with decimals, students need to apply the properties of calculations with decimals and the relationship between those calculations in calculation practice, and at the same time solve problems associated with solving problems (with one or several calculation steps) related to calculations with decimals. Developing the ability to think and reason mathematically about the content of decimal operations helps students enhance their understanding and develop their thinking.

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This study presents some basic issues about the ability to think and reason mathematically. At the same time, we propose some measures to develop the ability to think and reason mathematically for students through teaching the topic of Calculations with decimals in grade 5.

## II. MATHEMATICAL THINKING AND REASONING COMPETENCY

### A. What is Competency?

Competence is a broad and multidimensional concept, reflecting the ability of people to perform specific tasks, jobs, or activities. Competence is not only knowledge and skills but also includes attitudes, personal qualities, and the ability to adapt to the surrounding environment.

According to the Vietnamese dictionary: “Competence is the ability, subjective or natural condition available to perform a certain activity. Psychological and physiological qualities allow people to complete a certain activity with high quality”.

Author F.E. Weiner believes that: “Competence is the skills and techniques learned or available to individuals to solve specific situations, as well as the readiness of social motivation... and the ability to apply problem-solving methods responsibly and effectively in flexible situations”. Author Tremblay Denyse: “Competence is the ability to act, achieve success and demonstrate progress thanks to the ability to mobilize and effectively use many integrated resources of the individual when solving life problems”. According to the Organization of Economically Developed Countries OECD: “Competence is the ability of an individual to meet complex requirements and successfully perform tasks in a specific context”.

The general education program issued with Circular 32/2018/TT-BGDĐT, the concept of competence according to the General education program is as follows: competence is a personal attribute formed and developed thanks to innate qualities and the learning and training process, allowing people to mobilize a synthesis of knowledge, skills and other personal attributes such as interest, belief, will, ... to successfully perform a certain type of activity, achieving desired results under specific conditions

### B. Characteristics competency

Individuality of competencies: Each individual has a unique set of competencies, reflecting their unique combination of knowledge, skills and attitudes. These factors are not only dependent on education and training, but are also influenced by life experiences, culture and social environment. For example, an IT engineer needs not only knowledge of programming and system analysis, but also the ability to work in a team, think creatively and solve problems. These factors create a unique “stamp” for each person's competencies, making them different and unique.

Dynamicity of competencies: Competency is not a fixed entity, but changes over time and situations. It develops and evolves through learning, working and life experiences. Workers in the modern environment need to constantly update their knowledge and skills to adapt to the constant changes in technology and job requirements. This process is called “lifelong learning”, an important factor in maintaining and developing personal competence.

Integrity of competence: Competence is the integration of many different factors. To perform a task well, an individual needs to combine knowledge, skills and attitudes flexibly and effectively. For example, a project manager needs not only specialized knowledge in his field but also leadership, communication, and time management skills. This integration helps individuals not only complete the job but also achieve excellent results.

Contextuality of competence: An individual's competence does not exist in a vacuum, but is always closely related to the context in which they operate. A skill may be very important in a particular context, but not valuable in another context. For example, the ability to negotiate may be very important for a salesperson, but not so necessary for a programmer. Therefore, when assessing competence, it is necessary to consider the specific context in which the individual operates.

### C. Mathematical Thinking and Reasoning Competency

Thinking is a psychological phenomenon, a high-level cognitive activity in humans. The physiological basis of thinking is the activity of the cerebral cortex. Thinking activity is synonymous with intellectual activity. Thinking aims to find philosophies, theories, methodologies, methods, and solutions in human activity situations.

Mathematical thinking and reasoning ability is one of the important factors contributing to human intellectual development. It not only helps individuals solve problems related to mathematics but also develops logical thinking, analysis, and problem-solving skills in many other fields. This essay will analyze aspects of mathematical thinking and reasoning ability, including the concept, importance, constituent elements, and methods for developing this ability.

Mathematical thinking and reasoning competency is the ability to use mathematical concepts, methods, and tools to analyze and solve problems. It includes the ability to identify, model, solve problems and think critically. A person with good mathematical thinking and reasoning ability can approach a complex problem, break it down into simpler parts, and apply mathematical methods to find a solution.

In the 2018 Math General Education Program, mathematical thinking and reasoning ability is defined as including the following manifestations:

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- Performing thinking operations (at a simple level), especially knowing how to observe, find similarities and differences in familiar situations and describe the results of observation.
- Presenting evidence, reasoning and knowing how to reason logically before concluding.
- Raising and answering questions when reasoning and solving problems. Initially pointing out evidence and reasoning with basis and reasoning before concluding.

### **D. Some measures to develop students' mathematical thinking and reasoning ability through teaching the topic of calculations with decimal numbers in grade 5**

Measure 1: Teaching addition, subtraction, multiplication and division of decimal numbers in the direction of developing mathematical thinking and reasoning abilities.

Teaching addition, subtraction, multiplication and division of decimal numbers in the direction of developing mathematical thinking and reasoning abilities helps students not only perform the calculations correctly but also understand more deeply the nature of numbers and calculation operations.

Teaching addition, subtraction, multiplication and division of decimal numbers is based on converting units of measurement and performing calculations with natural numbers. Therefore, it is similar to natural numbers in the way of placing and performing calculations, but there are differences when performing calculations with decimal numbers: There is a comma, an integer part, and a decimal part.

How to proceed

Step 1: Present a practical situation

The teacher creates a situation related to daily life.

Step 2: State the calculation

The teacher guides students to identify this problem as a type of problem related to decimal calculation. Students present the calculation.

Step 3: Organize students to mobilize relevant knowledge they have learned to find the calculation result

Students point out evidence of knowledge they have learned about units of measurement and how to perform calculations with natural numbers and fractions. For example:

Converting units of measurement: Calculations with decimal numbers are often associated with practical problems about quantities such as length, mass, area. When performing calculations, students need to recognize and convert between units of measurement.

Calculations with natural numbers: The way to perform addition, subtraction, multiplication, and division with decimal numbers is similar to that with natural numbers in some aspects such as how to set up calculations and how to calculate. However, the biggest difference is in the way of handling commas and decimals. Students need to understand how to move the comma or how to work with whole numbers and decimals when performing calculations.

Step 4: Answer the initial practical situation question

After calculating, students can answer the question in the given situation.

Step 5: Guide students to perform the calculation and then calculate with decimals

Step 6: Teachers organize students based on the examples they have done to draw their own rules.

After completing the above steps, teachers encourage students to find a similar example in their daily lives and perform the entire problem-solving process according to the steps they have learned. Students will discuss and share their solutions to the situation to strengthen their mathematical skills and thinking.

Measure 2. Teaching practical problem solving related to decimal calculations in the direction of developing mathematical thinking and reasoning skills.

In addition to learning decimal calculations, students also develop logical thinking and reasoning skills through analyzing and solving practical problems, thereby clearly seeing the application of mathematics in life, increasing interest in learning. This method also helps students identify and solve complex problems, while improving self-study and cooperation skills through group activities and self-research.

How to proceed

Step 1: Present a practical situation

The teacher presents a problem related to decimal calculations, asks students to read the problem carefully and identify important information.

Step 2: Analyze the situation

Students need to clearly understand what the problem is referring to, identify important factors, and clarify what needs to be done to solve the problem. This is an important step to help students develop their analytical thinking and reasoning skills to find a way

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to solve the situation. Students need to determine which calculation the problem requires (addition, subtraction, multiplication, division) and clarify whether it is a sum, difference, or another calculation.

Step 3: Solve the problem

Students need to come up with a solution and perform the correct calculation based on the previous situation analysis and make a solid argument for each step of the solution. When solving the problem, students must rely on evidence from the previous analysis to perform the correct calculation.

Step 4: Check the results

This is a very important step to check the results to develop students' critical thinking and mathematical reasoning skills. Checking not only helps ensure accuracy but also trains the skills of self-assessment and analysis of their problem solving process. When checking the results, students need to rely on specific evidence from the calculation process and argue that their results are reasonable compared to the original data to confirm that their answer is correct. Pointing out evidence from the calculation process and clearly arguing about the correctness of the results not only helps them ensure accuracy but also helps build the ability to solve problems confidently and with basis.

Measure 3. Create opportunities for students to develop critical thinking through detecting and correcting mistakes.

In the process of learning mathematics, detecting and correcting mistakes is an important part of thinking development. Instead of considering mistakes as failures, teachers can take advantage of them as opportunities to encourage students to develop critical thinking and mathematical reasoning.

Learning decimal operations in grade 5 requires students to become familiar with new concepts and skills. In particular, the appearance of decimals and performing calculations on them can easily confuse students. Therefore, developing critical thinking through mistakes not only helps students avoid repeating mistakes but also helps them build analytical and logical reasoning skills in mathematics.

How to proceed

Critical thinking is the process in which students use systematic reasoning to detect and analyze errors in the process of performing math problems. To help students develop critical thinking when performing decimal addition, we follow these steps:

Step 1: Provide a situation or calculation

Step 2: Create opportunities for students to detect mistakes

Step 3: Recheck the calculation

Step 4: Correct mistakes

Step 5: Encourage students to draw their own lessons

### III. CONCLUSIONS

Developing mathematical thinking and reasoning competency for students is an important goal in teaching Mathematics and should be focused on right from primary school. Teaching calculations with decimals is inherited from teaching calculations with natural numbers and calculations with fractions learned in previous grades. In addition, teaching calculations with decimals in grade 5 must be carried out in conjunction with practice and teaching conditions at school. Therefore, teachers must be flexible and creative in implementing measures to achieve the best results.

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