International Journal of Social Science and Human Research

ISSN (print): 2644-0679, ISSN (online): 2644-0695

Volume 09 Issue 03 March 2026

DOI: 10.47191/ijsshr/v9-i3-67, Impact factor- 8.361

Page No: 2280-2284

Developing Algorithmic Thinking for Students in Teaching the Topic of Decimal Numbers and Operations with Decimal Numbers in Grade 5th

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ABSTRACT: In the primary school mathematics curriculum, the formation and development of students' thinking play a particularly important role. Among various types of thinking, **algorithmic thinking** is a crucial component that enables students to perform mathematical operations systematically and logically. The topic *Decimal Numbers and Operations with Decimal Numbers* in Grade 5 offers significant potential for fostering algorithmic thinking through learning activities associated with calculation procedures and problem solving. This paper clarifies several concepts related to thinking, algorithms, and algorithmic thinking; analyzes the content of the topic *Decimal Numbers and Operations with Decimal Numbers* in the Vietnamese primary mathematics curriculum; and proposes several pedagogical measures to develop algorithmic thinking for Grade 5 students in teaching this topic. These measures are designed to promote students' active learning, enabling them to gradually recognize, construct, and apply algorithmic procedures in mathematical learning. The research results provide both theoretical and practical foundations for primary school teachers in organizing the teaching of decimal numbers toward developing students' algorithmic thinking, thereby contributing to improving the quality of mathematics education at the primary level.

KEYWORDS: Algorithmic thinking; decimal numbers; mathematics teaching; Grade 5th students; primary education.

I. INTRODUCTION

In the current context of educational reform, the goal of teaching mathematics at the primary level is not only to equip students with basic knowledge and computational skills but also to develop their mathematical thinking and competencies. The 2018 General Education Mathematics Curriculum emphasizes organizing learning activities that enable students to develop mathematical competencies through exploration, reasoning, and problem solving (MOET, 2018). Developing different forms of mathematical thinking from the early stages of schooling plays an important role in students' intellectual development and long-term learning ability.

One important type of thinking that should be cultivated in mathematics learning is **algorithmic thinking**. Algorithmic thinking refers to the ability to identify and perform problem-solving procedures in a logical and systematic sequence that can be applied repeatedly in similar situations. According to Wing (2006), algorithmic thinking forms the foundation of computational thinking and plays a vital role in developing learners' problem-solving abilities in modern education. In mathematics education, algorithmic thinking helps students understand the nature of calculation procedures, analyze problem-solving steps, and gradually develop the ability to generalize mathematical methods.

In the Grade 5 mathematics curriculum, the topic *Decimal Numbers and Operations with Decimal Numbers* plays an important role in consolidating and extending students' understanding of numbers after learning natural numbers and fractions. This topic not only helps students master decimal calculations but also provides favorable conditions for developing algorithmic thinking through recognizing and implementing procedures for addition, subtraction, multiplication, and division of decimal numbers. Through these learning activities, students can develop the ability to analyze problems, determine solution steps, and apply calculation rules appropriately (Huong LTT, 2025).

However, in practice, the potential of mathematical content to develop algorithmic thinking has not been fully exploited in primary mathematics teaching. Many classroom activities still focus mainly on guiding students to perform calculations according to given rules without creating sufficient opportunities for them to identify and construct algorithmic procedures when solving problems. From the need to innovate mathematics teaching toward developing students' thinking and from challenges observed in teaching practice, this study proposes several pedagogical measures to develop algorithmic thinking for Grade 5 students when teaching the topic *Decimal Numbers and Operations with Decimal Numbers*.

II. RESEARCH METHODS

This study employed both theoretical and practical research methods to clarify the scientific basis for proposing pedagogical measures aimed at developing algorithmic thinking for Grade 5 students in teaching the topic *Decimal Numbers and Operations with Decimal Numbers*. Document analysis was used to examine previous studies on thinking, algorithmic thinking, and mathematics teaching at the primary level in order to establish the theoretical framework of the research (Wing, 2006; Nguyen, 2016). In addition, curriculum documents and teaching materials for primary mathematics, particularly the 2018 Mathematics Curriculum, were analyzed to determine the expected learning outcomes related to decimal numbers (MOET, 2018). Furthermore, classroom observation and analysis of teaching practices were conducted to investigate the current implementation of teaching this topic in Grade 5, thereby providing a practical basis for proposing appropriate pedagogical measures (Huong LTT, 2025).

III. RESEARCH RESULTS

3. Research Results

3.1. Some Concepts

3.1.1. Thinking and Characteristics of Thinking

Thinking is a cognitive process that reflects the essential attributes and relationships of objects and phenomena that cannot be perceived directly through sensory experience. In learning activities, thinking enables learners to analyze, compare, generalize, and solve problems. According to cognitive psychology, thinking is an intellectual activity aimed at identifying and solving problems through the mobilization of knowledge, experience, and intellectual operations such as analysis, synthesis, comparison, and generalization (Polya, 1957).

In primary mathematics education, students' thinking is typically developed through problem-solving activities. Through learning tasks, students gradually develop logical reasoning abilities, identify patterns, and explore different problem-solving methods. Nguyen Danh Nam (2016) emphasized that organizing learning activities to develop students' thinking not only helps them understand the nature of mathematical knowledge but also contributes to forming their problem-solving abilities in learning and everyday life.

Mathematical thinking in general and algorithmic thinking in particular possess several fundamental characteristics such as logicality, generalization, and systematic organization. These characteristics enable students to recognize mathematical relationships, construct problem-solving procedures, and apply these procedures in similar situations. Therefore, fostering various forms of thinking from the primary level plays an essential role in building students' intellectual foundation and long-term learning capacity (Huong LTT et al, 2024).

3.1.2. Algorithms and Levels of Algorithmic Thinking

An algorithm can be understood as a finite sequence of ordered steps designed to solve a problem or a class of problems. Each step in an algorithm must be clearly defined, executable, and capable of leading to a result after a finite number of steps. In mathematics, many calculation rules and problem-solving methods can be expressed in algorithmic form (Nguyen, 2016).

Algorithmic thinking refers to the ability to identify, construct, and execute problem-solving procedures in a logical sequence. According to Wing (2006), algorithmic thinking is an important component of computational thinking that enables learners to analyze problems, determine appropriate steps, and organize these steps into repeatable procedures.

In primary mathematics learning, algorithmic thinking often develops through students' experiences in solving mathematical problems and performing calculations. Students' algorithmic thinking can be expressed at several levels:

- **Recognizing problem-solving procedures:** Students identify the steps required to solve a type of problem or perform a calculation.
- **Executing procedures:** Students carry out the steps of the procedure in the correct order.
- **Describing and explaining procedures:** Students can express the steps of a solution using verbal explanations or mathematical symbols.
- **Applying and generalizing procedures:** Students apply learned procedures to similar situations and gradually generalize mathematical methods.

Teaching oriented toward algorithmic thinking enables students to understand the essence of computational procedures and enhances their ability to learn mathematics and solve real-world problems.

3.2. The Topic Decimal Numbers and Operations with Decimal Numbers *in the Vietnamese Mathematics Curriculum*

In the Vietnamese primary mathematics curriculum, the content of **decimal numbers and operations with decimal numbers** is mainly taught in Grade 5 and plays an important role in completing students' understanding of number concepts. According to the 2018 General Education Mathematics Curriculum, teaching this content not only helps students understand the concept of decimal numbers and perform decimal operations but also contributes to developing mathematical thinking and problem-solving abilities (MOET, 2018).

Developing Algorithmic Thinking for Students in Teaching the Topic of Decimal Numbers and Operations with Decimal Numbers in Grade 5th

The topic of decimal numbers in Grade 5 mathematics includes fundamental knowledge such as the concept of decimal numbers, reading and writing decimal numbers, comparing decimal numbers, and performing operations with decimals, including addition, subtraction, multiplication, and division. Through learning these topics, students gradually develop the ability to perform calculations according to certain rules and apply these rules to solve related mathematical problems. In essence, the procedures for performing operations with decimals represent **algorithmic processes**, in which each operation follows a specific sequence of steps (Nguyen, 2016).

Furthermore, decimal numbers are widely used in real-life situations involving measurement, calculation in everyday life, and problems related to quantities such as length, mass, time, and money. Through such problems, students have opportunities to apply computational procedures and gradually develop the ability to analyze problems, identify solution steps, and select appropriate operations (Huong LTT, 2025).

From a pedagogical perspective, the topic *Decimal Numbers and Operations with Decimal Numbers* provides rich opportunities for developing students' algorithmic thinking. Performing decimal operations requires students to identify the steps of calculation procedures, follow these steps in the correct sequence, and verify the correctness of results after performing calculations. Therefore, if teachers organize appropriate learning activities, this topic can become an effective environment for fostering algorithmic thinking among Grade 5 students.

3.3. Some Pedagogical Measures to Develop Algorithmic Thinking for Grade 5 Students in Teaching the Topic of Decimal Numbers and Operations with Decimal Numbers

Teaching mathematics toward developing algorithmic thinking requires organizing learning activities that help students recognize problem-solving procedures, perform solution steps logically, and gradually generalize mathematical methods. In teaching the topic *Decimal Numbers and Operations with Decimal Numbers*, teachers can organize appropriate activities to foster algorithmic thinking through analyzing and implementing calculation procedures (Wing, 2006; Nguyen, 2016). Based on this orientation, several pedagogical measures are proposed.

3.3.1. Measure 1: Organizing Learning Activities to Help Students Identify and Describe Procedures for Performing Decimal Calculations

1) Purpose

This measure aims to help students recognize the steps involved in performing decimal operations, thereby developing the ability to carry out calculations systematically and logically.

2) Implementation

Step 1. Selecting appropriate learning tasks

Teachers select typical tasks from the decimal topic such as addition, subtraction, multiplication, or division of decimal numbers that are appropriate for Grade 5 students' cognitive level.

Step 2. Organizing students to perform calculations.

Students solve problems or perform calculations based on their initial understanding. Teachers observe students' performance and identify common errors during the calculation process.

Step 3. Guiding students to analyze the procedure.

From specific solutions, teachers ask students to identify each step they performed, such as arranging numbers vertically, calculating digits in order, and determining the position of the decimal point.

Step 4. Asking students to describe the procedure.

Students explain the calculation procedure using words, diagrams, or step-by-step lists. This activity helps students move from simply "following rules" to understanding the calculation process.

Step 5. Consolidating and generalizing the procedure.

Teachers summarize the standard procedure and help students generalize it as a sequence of steps that can be applied to similar exercises.

3.3.2. Measure 2: Guiding Students to Construct and Represent Algorithms for Performing Decimal Calculations

1) Purpose

This measure aims to develop students' ability to construct, represent, and explain calculation procedures in the form of algorithms, thereby fostering logical and sequential thinking (Nguyen, 2016).

2) Implementation

Step 1. Reviewing previously learned procedures.

Teachers ask students to recall the steps involved in performing a specific decimal operation, such as addition or division of decimals.

Step 2. Identifying key operations.
Students determine essential operations within the procedure, such as aligning numbers, performing calculations, placing the decimal point, and checking results.
Step 3. Organizing the steps logically.
Teachers guide students in arranging the identified operations into a logical sequence that forms a complete calculation procedure.
Step 4. Representing the algorithm.
Students represent the procedure using numbered steps, flowcharts, tables, or concise verbal explanations.
Step 5. Testing and refining the algorithm.
Students apply the constructed algorithm to similar exercises and refine the procedure when necessary.
3.3.3. Measure 3: Using Transformational Problems to Develop Algorithmic Thinking
1) Purpose
This measure helps students apply learned algorithms to situations with modified data or requirements, thereby developing adaptability and the ability to generalize algorithms (Wing, 2006; Huong LTT, 2025).
2) Implementation
Step 1. Designing sets of related problems.
Teachers create problems that share the same structure but differ in data, context, or level of complexity.
Step 2. Helping students identify similarities and differences.
Students analyze the problems to determine which aspects are similar to previously learned problems and which aspects are new.
Step 3. Applying appropriate algorithms.
Students select and apply the suitable procedure to solve the new problem.
Step 4. Comparing solution methods.
Students compare different solutions and identify similarities and adjustments needed in the procedures.
Step 5. Generalizing the procedure.
Teachers guide students to draw general conclusions about the problem-solving procedures.
3.3.4. Measure 4: Organizing Activities for Comparing and Generalizing Calculation Procedures
3) Purpose
This measure aims to help students recognize relationships among different calculation procedures and develop the ability to generalize algorithms (Huong LTT, 2025).
4) Implementation
Step 1. Selecting problems for comparison.
Teachers choose two or more calculations or problems that are related, such as addition and subtraction of decimals or multiplication of decimals by 10, 100, or 1000.
Step 2. Asking students to perform each procedure.
Students solve the problems using different procedures.
Step 3. Comparing the steps involved.
Students analyze similarities and differences among the procedures.
Step 4. Discussing efficiency and reasonableness.
Students evaluate which procedures are easier, more accurate, or more appropriate in different situations.
Step 5. Generalizing the procedures.
Teachers guide students to summarize common features of decimal calculation procedures and develop awareness of selecting appropriate algorithms.

IV. CONCLUSIONS

In primary mathematics education, developing different forms of thinking is essential for students' intellectual growth and learning abilities. Among these forms, **algorithmic thinking** plays a particularly important role in enabling students to perform problem-solving processes in a logical and systematic manner. Through mathematical learning activities, especially when performing calculations and solving problems, students can identify, construct, and apply algorithmic procedures (Wing, 2006).
Based on theoretical foundations of thinking, algorithms, and algorithmic thinking, this paper analyzed the content of the topic *Decimal Numbers and Operations with Decimal Numbers* in the Grade 5 mathematics curriculum of Vietnam. The analysis indicates that this topic has significant potential for developing students' algorithmic thinking through learning activities associated with calculation procedures (MOET, 2018).
From these theoretical and practical foundations, the study proposed several pedagogical measures to develop algorithmic thinking for Grade 5 students when teaching decimal numbers. These measures focus on helping students recognize calculation procedures, construct and represent algorithms, apply algorithms to modified problems, and compare and generalize calculation procedures.

Organizing learning activities in this way helps students better understand the nature of mathematical procedures while simultaneously enhancing logical thinking and problem-solving abilities (Huong LTT, 2025).

The research results provide useful references for primary school teachers in organizing the teaching of decimal numbers toward developing algorithmic thinking. Future studies should conduct pedagogical experiments to evaluate the effectiveness of the proposed measures in specific classroom contexts in order to further improve the quality of primary mathematics education.

V. FUNDING

This research was funded by Thai Nguyen University and Thai Nguyen University of Education under grant number ĐH2024-TN04-02.

REFERENCES

1) Duong, L. T., Huong, L. T. T., & Luong, T. T. T. (2024). Teaching decimal operations to develop mathematical thinking and reasoning competency for primary school students in Vietnam. *International Journal of Social Science and Human Research*, 7(10).
2) Huong, L. T. T., & Huong, V. L. (2025). Some measures to develop abstract and generalizing thinking for 4th-grade students in teaching the topic of calculations with fractions. *International Journal of Social Science and Human Research*, 7(10), 7985–7988.
3) Ministry of Education and Training. (2018). *General education curriculum: Mathematics curriculum*. Hanoi, Vietnam: Ministry of Education and Training.
4) Nguyen, D. N. (2016). *Mathematical modeling methods in mathematics teaching at general schools*. Thai Nguyen, Vietnam: Thai Nguyen University Publishing House.
5) Nguyen, C. T., Trinh, T. P. T., & Doan, T. M. T. (2025). Developing algorithmic thinking for primary teacher education students through teaching Scratch programming. In *Proceedings of the National Scientific Conference: Current situation and solutions for implementing the primary general education curriculum* (pp. 181–191). Hue University Publishing House.
6) Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. Basic Books.
7) Polya, G. (1957). *How to solve it: A new aspect of mathematical method* (2nd ed.). Princeton University Press.
8) Selby, C., & Woollard, J. (2013). Computational thinking: The developing definition. In *Proceedings of the 2013 ITiCSE Conference Working Group Reports* (pp. 5–8).
9) Shute, V. J., Sun, C., & Asbell-Clarke, J. (2017). Demystifying computational thinking. *Educational Research Review*, 22, 142–158. https://doi.org/10.1016/j.edurev.2017.09.003
10) Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, 49(3), 33–35. https://doi.org/10.1145/1118178.1118215
11) Wing, J. M. (2008). Computational thinking and thinking about computing. *Philosophical Transactions of the Royal Society A*, 366(1881), 3717–3725. https://doi.org/10.1098/rsta.2008.0118
12) Yadav, A., Hong, H., & Stephenson, C. (2016). Computational thinking for teacher education. *Communications of the ACM*, 59(4), 55–62. https://doi.org/10.1145/2994591



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