

Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students

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ABSTRACT: Mathematical problem-solving competence is one of the five core components of mathematical competency. The topic Decimals and Decimal Operations constitutes a central content area within the Numbers and Operations strand of the Grade 5 Mathematics curriculum. This paper proposes several teaching approaches to decimals and decimal operations oriented toward developing students' mathematical problem-solving competence in Grade 5.

KEYWORDS: Mathematics, teaching, competence, mathematical problem-solving

INTRODUCTION

Competency-based teaching and learning have been implemented across general education schools in Vietnam. The Vietnamese Mathematics Curriculum identifies five components of mathematical competence that students should be trained in, among which problem-solving competence plays a key role. The topic Decimals and Decimal Operations is introduced in Grade 5. Therefore, teaching decimals and decimal operations with an emphasis on developing mathematical problem-solving competence is essential and meaningful.

Content

1. Problem-Solving Competence

There exist various perspectives on the concept of competence. In this paper, we refer to the definition provided in the General Education Curriculum of Vietnam: "Competence is an individual attribute that is formed and developed based on innate qualities and through learning and training processes, enabling a person to effectively mobilize an integrated set of knowledge, skills, and other personal attributes such as interests, beliefs, and willpower to successfully perform specific types of activities and achieve desired outcomes under given conditions" [1].

This definition highlights that: Competence is a combination of innate qualities and learning/training processes; Competence integrates knowledge, skills, and personal attributes such as motivation, belief, and perseverance; Competence is formed and developed through active engagement and is demonstrated through successful performance in practical contexts [3].

The General Education Curriculum also outlines the structure of problem-solving competence, including the following components: (i) Identifying and clarifying problems; (ii) Proposing and selecting solutions; (iii) Implementing and evaluating solutions; (iv) Recognizing new ideas; (v) Forming and developing new ideas; (vi) Independent thinking [1].

According to Nguyễn Lan Phương [2], problem-solving competence consists of four main components:

- Understanding the problem – Recognizing problematic situations; identifying and interpreting relevant information; sharing understanding of the problem with others.
- Establishing the problem space – Collecting, organizing, and evaluating the reliability of information; connecting information with prior knowledge; identifying methods, processes, and strategies for problem-solving; coordinating actions to establish a shared problem space.
- Planning and implementing solutions – Designing a sequence of actions to execute the selected solution; allocating and utilizing resources effectively; performing and presenting the problem solution; organizing and maintaining group work during the implementation process.
- Evaluating and reflecting on the solution – Assessing the effectiveness of the implemented solution; reflecting on the value of the solution; confirming and generalizing knowledge to similar problems; evaluating individual roles and contributions within the group activity.

Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students

2. Teaching Decimals and Decimal Operations towards Developing Problem-Solving Competence for Grade 5 Students

2.1. Principles of Teaching Decimals and Decimal Operations that Contribute to the Development of Students' Problem-Solving Competence

Principle 1. Comply with the theoretical foundations of mathematics instruction in teaching the topic Decimals and Decimal Operations.

Principle 2. Create opportunities for Grade 5 students to develop problem-solving competence through learning activities related to decimals and decimal operations.

Principle 3. Design learning situations connected with real-life contexts and familiar to students.

Principle 4. Design learning activities appropriate to the psychological characteristics and cognitive level of Grade 5 students.

Principle 5. Ensure that the proposed activities and situations are feasible for implementation in current primary school settings.

2.2. Teaching the Topic Decimals and Decimal Operations with a Focus on Developing Problem-Solving Competence in Grade 5 Students

2.2.1. Designing Introductory Activities Linked to Real-Life Situations

a) Purpose of the measure

This measure aims to help students:

- Apply their knowledge of decimals and decimal operations in learning activities connected with real-life situations.
- Develop interest and engagement in learning when addressing real-world problems.
- Have opportunities to develop practical problem-solving competence.
- Reinforce and deepen their understanding of mathematical concepts learned.

b) Implementation procedure

When applying this measure, teachers may follow the steps below:

Step 1. Designing real-life situations

Teachers should design real-life situations that create a meaningful learning environment and stimulate students' interest. The chosen situations should be relevant and practical to students' everyday experiences and contain mathematical elements that require problem-solving. When designing the situation, teachers must ensure its authenticity, age-appropriateness, and alignment with the content and learning outcomes specified in the Grade 5 Mathematics curriculum.

Step 2. Guiding students to identify the problem

Teachers organize activities that enable students to recognize the mathematical problem embedded in the real-life situation. This process should promote students' initiative, creativity, and collaboration. Teachers can arrange students to work in pairs or small groups to discuss what the problem asks, and which mathematical knowledge or skills are required to address it.

Step 3. Guiding students to analyze the problem

After identifying the mathematical problem to be solved, teachers organize learning activities that encourage students to actively participate in analyzing and finding possible solutions. Students may work individually, in pairs, or in groups to exchange and discuss possible methods of solving the problem.

c) Notes for implementation

- Real-life situations should be familiar and closely related to students' daily lives and learning experiences.
- Situations should not be overly complex but must be appropriate for the cognitive level of Grade 5 students.
- Situations must contain a real problem to be addressed.
- The problem should not be too simple; it should be challenging enough to arouse students' curiosity and interest when learning the topic Decimals and Decimal Operations.

d) Illustrative example

Example: Designing an introductory activity connected with real-life contexts when teaching the content "Rounding a decimal number to the nearest tenth."



Cuc Phuong National Park

Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students

Step 1. Designing Real-Life Situations

Analysis: Cuc Phuong National Park is a nature reserve and special-use forest located in Ninh Binh Province. The park covers an area of 22,408 hectares, equivalent to 224.08 square kilometers. This situation introduces students to Cuc Phuong National Park, a natural sanctuary nestled deep within the Tam Diep mountain range.

Step 2. Guiding Students to Identify the Problem

The teacher organizes for students to read the situation and share what they know about Cuc Phuong National Park. Students engage in a short role-play activity in front of the class:

Student: The area of Cuc Phuong National Park is 224.08 km².

Teacher: Cuc Phuong National Park has an area of about 224.1 km².

Student: Do you know why the teacher said that?

Mathematical problem to be solved: Explain why the teacher said that “Cuc Phuong National Park has an area of about 224.1 km².”

Step 3. Guiding Students to Analyze the Problem

Students identify:

The exact area of Cuc Phuong National Park: 224.08 km².

The approximate area: 224.1 km².

Students then observe and compare the integer and decimal parts of the two numbers, 224.08 and 224.1. From this, the teacher introduces the concept:

The teacher in the situation rounded the decimal number to the nearest tenth.

Finally, the teacher raises the learning problem:

To understand how the teacher rounded the decimal number to the nearest tenth, let's begin our lesson.

2.2.2. Designing Knowledge Discovery Activities Oriented Toward Developing Problem-Solving Competence

a) Purpose of the measure

This instructional measure aims to help students:

- Actively, positively, and creatively engage in the learning process through experiential and exploratory activities.
- Have opportunities to apply mathematical knowledge to solve real-life problems, thereby enhancing their problem-solving competence.

b) Implementation procedure

Step 1. Identify the learning objectives and key knowledge to be developed.

Determine the expected learning outcomes and the specific mathematical knowledge to be formed. Based on these objectives, design a real or hypothetical real-life situation relevant to the intended content.

Step 2. Organize exploratory activities through problem-solving.

After identifying the learning problem and desired outcomes, the teacher guides students through discovery activities using flexible and engaging methods. The teacher introduces the problem in an attractive way—possibly through images, videos, or real objects—to stimulate students' curiosity. The class is divided into small groups to discuss and propose possible solutions.

Step 3. Apply newly acquired mathematical knowledge to problem-solving.

After students have discovered and constructed new knowledge, the teacher designs follow-up activities that allow students to apply what they have learned to solve mathematical problems. Through these tasks, students conduct self-assessment and receive peer and teacher feedback.

c) Notes for implementation

- Ensure that the content of the activities aligns with the learning objectives specified in the General Education Mathematics Curriculum.
- Activities should be appropriate to students' age, cognitive development, and living environment.
- During instruction, teachers should provide opportunities for students to experience, explore, and construct knowledge naturally and sustainably through active participation.

d) Illustrative Example

Example: Designing an exploratory learning activity on comparing decimal numbers oriented toward developing students' problem-solving competence.

Step 1: Identify the learning objectives and key knowledge.

Learning objective: Recognize how to compare two decimal numbers.

Knowledge to be acquired: The rule for comparing two decimal numbers.

Step 2: Organize exploratory learning activities through problem-solving.

Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students



Can Tho Bridge: 2.75 km



An Dong Bridge: 3.5 km



Long Bien Bridge: 2.29 km

Teaching procedure: The teacher organizes for students to observe pictures of Can Tho Bridge and An Dong Bridge and answer the following questions:

- How long is Can Tho Bridge? (2.75 km)
- How long is An Dong Bridge? (3.5 km)

Students are then asked to compare the lengths of the two bridges. The teacher facilitates group work in which students compare the lengths of Can Tho Bridge and An Dong Bridge.

Students perform unit conversions as follows: $2.75\text{ km} = 2\,750\text{ m}$; $3.5\text{ km} = 3\,500\text{ m}$.

They then compare the two measurements: $2\,750\text{ m} < 3\,500\text{ m}$ Or: $2.75\text{ km} < 3\,500$

Students conclude that Can Tho Bridge is shorter than An Dong Bridge, or equivalently, An Dong Bridge is longer than Can Tho Bridge.

The teacher asks students to compare the whole-number parts of the two decimal numbers 2.75 and 3.5. Students identify that the whole-number part of 2.75 is 2, and that of 3.5 is 3; since $(2 < 3)$, it follows that $(2.75 < 3.5)$.

The teacher introduces the rule:

When the whole-number parts of two decimal numbers are different, the number with the smaller whole-number part is smaller.

Next, the teacher organizes for students to observe Can Tho Bridge and Long Bien Bridge, then answer the questions:

How long is Can Tho Bridge? (2.75 km)

How long is Long Bien Bridge? (2.29 km)

Students work in groups to compare the lengths of the two bridges.

They perform the conversion:

$2.75\text{ km} = 2\,750\text{ m}$; $2.29\text{ km} = 2\,290\text{ m}$ and then students compare: $2\,750\text{ m} > 2\,290\text{ m}$, or $2.75\text{ km} > 2.29\text{ km}$.

Students conclude that Can Tho Bridge is longer than Long Bien Bridge because $(2.75 > 2.29)$.

The teacher guides students to compare both the whole-number parts and decimal parts of the two numbers 2.75 and 2.29. The teacher explains:

The whole-number parts of the two decimals are equal (both are 2). The tenths digit of 2.75 is 7, and that of 2.29 is 2. Since $(7 > 2)$, it follows that $(2.75 > 2.29)$.

The teacher then asks students to formulate a rule for comparing decimal numbers when their whole-number parts are equal. Based on student responses, the teacher presents the accurate rule.

Finally, the teacher introduces the case where both the whole-number and decimal parts are equal:

When both the whole-number and decimal parts are the same, the two decimal numbers are equal.

Step 3: Applying New Mathematical Knowledge to Problem Solving

1. Identify which animal is heavier and which is lighter. Explain your reasoning.

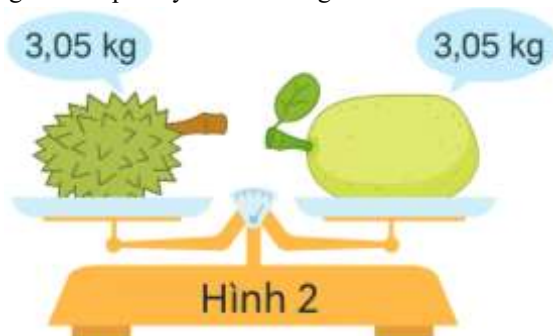


The teacher organizes for students to observe the picture and read the mass measurements of each animal shown. Students are then asked to compare the weights of the two animals.

Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students

Students obtain the following results: The cat weighs 2.75 kilograms; The chicken weighs 2.54 kilograms. Students conclude that the cat is heavier than the chicken, because $2.75 \text{ kg} > 2.54 \text{ kg}$. (This activity applies the rule for comparing two decimal numbers when the whole-number parts are equal.)

2. Which fruit is heavier and which is lighter? Explain your reasoning.

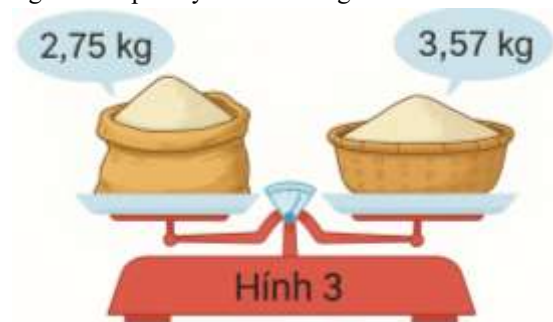


Organization Students' Activity

Students observe the picture and read the mass of each type of fruit shown. They identify that the durian weighs 3.05 kilograms, and the jackfruit weighs 3.05 kilograms.

The teacher organizes for students to compare the weights of the two fruits. Students conclude that the whole-number parts are equal, and the decimal parts are also equal, so the jackfruit and the durian have the same weight.

3. Which object is heavier and which is lighter? Explain your reasoning.



Students read the mass measurements of each object shown in the picture. They find that the rice bag weighs 2.75 kilograms, and the rice basket weighs 3.57 kilograms.

Students compare the two weights and conclude that the rice basket is heavier than the rice bag. By applying the rule for comparing two decimal numbers with different whole-number parts, they determine that $3.57 \text{ kg} > 2.75 \text{ kg}$.

2.2.3. Designing and Using a System of Practice Exercises Involving Real-World Problem Solving

a) Purpose of the Measure

This measure aims to help students:

- Have opportunities to apply mathematical knowledge and skills to solve practice problems related to real-life contexts.
- Develop practical problem-solving skills associated with real situations.
- Use the designed system of realistic exercises to foster problem-solving competence.

b) Steps for Implementing the Measure

Step 1. Analyze learning objectives and select real-life information

Before designing real-world exercises, it is essential to carefully study the learning objectives in the topic Decimal Numbers and Operations with Decimals.

Then, select and utilize real-world information appropriate to the lesson content. Such information should ensure three criteria: Be familiar to students' everyday lives; Contain realistic or plausible data; Include a mathematical problem to be solved.

The context and data should be adjusted to match the cognitive level and age of Grade 5 students, avoiding excessive complexity while remaining stimulating enough for learners to engage in mathematical reasoning.

Step 2. Design real-life-based exercises

Teachers design practice exercises with a strong real-life connection to encourage students' problem-solving competency development. A real-world problem is not merely a mathematical question with realistic data; rather, it places students in a specific context, requiring them to analyze the situation, identify the relevant data, and apply learned mathematical knowledge to find a solution.

Step 3. Organize learning activities for solving real-world problems

Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students

Teachers organize for students to solve the given real-life situations or problems. The teacher presents the learning tasks and guides students to participate in discussion and debate activities, through which they collaboratively identify and solve the mathematical problem posed.

c) Notes When Implementing the Measure

- The designed exercises should align with the learning objectives of the topic Decimal Numbers and Operations with Decimals.

- The problem context should be closely related to students' daily activities and learning experiences.

- The problem may provide authentic real-life information to help students broaden their understanding of the world.

d) Illustrative Examples

Step 1. Analyze learning objectives and select real-world information

Learning objective: Solve problems related to one-step or multi-step calculations involving operations with decimals.

Possible real-world information includes:

- Shopping or supermarket purchases, associated with addition of decimals or multiplying a decimal by a whole number.

- Measurement contexts such as time, area, and perimeter, associated with multiplying or dividing decimals, or adding decimals.

- Everyday life activities such as cooking, saving, paying for electricity or water, associated with calculating averages and performing operations with decimals.

Step 2. Designing real-life-based exercises

Problem 1. Hoa makes 2.3 liters of apricot juice and 2.1 liters of strawberry juice. How many liters of juice does Hoa make in total?

Analysis: Making fruit juice is a familiar daily-life activity for students. The problem provides a realistic hypothetical context, allowing students to apply addition of decimals to solve a situation rooted in real life.

Problem 2. Observe the picture and fill in the blanks

According to the Ministry of Agriculture and Environment, the rice export volume in May 2025 is estimated at 1.1 million tons, bringing the total rice export volume in the first five months of 2025 to 4.5 million tons. How many million tons of rice were exported in the first four months of 2025? [4]

Analysis: This problem presents authentic real-world data related to Vietnam's rice export situation. It aims to provide students with economic awareness while allowing them to practice subtraction with decimals in a meaningful context.

Problem 3. The price of RON 95-III gasoline is 20,360 VND per liter. Ms. Thủy fills a gas tank with a capacity of 5.2 liters. How much money does she have to pay for the gasoline? [5]

Analysis: This problem uses authentic market information. To solve it, students apply the rule for multiplying a whole number by a decimal to determine the total cost.

Problem 4. According to the Draft National Technical Standard on Average Fuel Consumption (CAFC), by the year 2030, the average fuel consumption of passenger cars in Vietnam should not exceed 4.83 liters per 100 kilometers. According to this draft, how many liters of fuel will a car consume on average per 1 kilometer?



Analysis: This problem contains authentic real-world information related to technology and environmental awareness. It provides students with insights into technological progress and energy efficiency goals, reinforcing their ability to apply division of decimals to a realistic context.

Step 3. Organizing Learning Activities to Solve Real-Life Mathematical Problems

Lesson 1 Students read the problem, identify the given information and what needs to be found.

Given information: Hoa made 2.3 liters of apricot juice and 2.1 liters of strawberry juice.

Required information: How many liters of apricot and strawberry juice did Hoa make in total?

Mathematical problem to solve: Find the total number of liters of apricot and strawberry juice by performing addition.

Knowledge to apply: Addition of two decimal numbers.

Students can summarize the problem as follows:

Apricot juice: 2.3 liters

Strawberry juice: 2.1 liters

Total amount of juice: ... liters?

Students work individually and write the solution in their notebooks.

Solution:

The total number of liters of apricot and strawberry juice that Hoa made is:

Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students

$$2.3 + 2.1 = 4.4 \text{ (liters)}$$

Answer: 4.4 liters of apricot and strawberry juice.

Whole-class activity: A student presents the solution. Other students give comments and ask questions. The teacher gives feedback.

Lesson 2 Students read the problem and identify the given and required information.

Given information: According to the report from the Ministry of Agriculture and Environment, the rice export volume in May 2025 is estimated at 1.1 million tons, bringing the total rice export volume for the first five months of 2025 to 4.5 million tons.

Required information: How many million tons of rice were exported in the first four months of 2025?

Mathematical problem to solve: Find the amount of rice exported in the first four months of 2025.

Students determine the way to solve it by performing subtraction.

Students work individually to solve the problem.

Solution:

The amount of rice exported in the first four months of the year is:

$$4.5 - 1.1 = 3.4 \text{ (million tons)}$$

Answer: 3.4 million tons of rice.

A student representative presents the solution. Other students comment and ask questions. The teacher provides feedback.

Lesson 3 Students read the problem and discuss with their partners about the given and required information.

Given information: The price of RON 95-III gasoline is 20,360 VND per liter. Ms. Thuy fills a gas tank with a capacity of 5.2 liters.

Required information: How much money does Ms. Thuy have to pay for that amount of gasoline?

Mathematical problem to solve: Find the total cost of buying 5.2 liters of RON 95 gasoline.

Students can summarize the problem as follows:

1 liter of RON 95 gasoline: 20,360 VND

5.2 liters of RON 95 gasoline: ... VND?

Students work in groups (using the “placemat technique”) to solve the problem.

Solution:

The total amount of money Ms. Thuy has to pay is:

$$20,360 \times 5.2 = 105,872 \text{ (VND)}$$

Answer: 105,872 VND.

A group representative presents the result of the discussion. Students comment and ask questions. The teacher gives feedback.

Lesson 4 Students read the problem and discuss with their partners about the given and required information.

What information does the problem provide? (According to the draft National Technical Standard on average fuel consumption (CAFC) for passenger cars in Vietnam, by 2030, the fuel consumption must reach 4.83 liters per 100 km).

What does the problem ask for? (According to this draft, how many liters of fuel does an average car consume per 1 km?)

Students write the solution in their notebooks.

Solution:

The average fuel consumption per 1 km is:

$$4.83 \div 100 = 0.0483 \text{ (liters)}$$

Answer: 0.0483 liters of fuel.

Whole-class activity: A student presents the solution. Other students give feedback and ask for an explanation of the method. The teacher comments.

CONCLUSION

Teaching Decimal Numbers and Operations with Decimal Numbers in the direction of developing mathematical problem-solving competence is carried out through introductory activities and knowledge-building tasks. In addition, teachers should design exercises and problem situations that create opportunities for students to develop their problem-solving skills. Therefore, in competency-based teaching in general—and in developing mathematical problem-solving competence in particular—it is essential to organize learning activities that allow students to learn through activity and by doing.

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Teaching Decimals and Decimal Operations Towards Developing Problem-Solving Ability for Grade 5 Students

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