

IMPROVING STUDENTS' CRITICAL THINKING ABILITIES THROUGH PROBLEM SOLVING ON FRACTIONS IN GRADE V ELEMENTARY SCHOOL

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Abstract

This study aims to determine students' critical thinking skills based on learning outcomes and analyze the differences between students' critical thinking skills and predetermined standard scores. This study uses a quantitative approach with descriptive analysis methods and hypothesis testing. The sample in this study amounted to 20 students. The research instrument used was a critical thinking skills test. Data analysis was carried out through a normality test using *Shapiro-Wilk* and a hypothesis test using *the Wilcoxon Signed-Rank Test* because the data did not meet the normality assumption. The results showed that the average value of students' critical thinking skills was 77.3, with a median value of 80.0 and a standard deviation of 8.66. Descriptively, the students' average score was above the comparison score, which was 75. The results of the normality test showed a significance value of $0.033 < 0.05$, so the data was declared not normally distributed. Furthermore, the results of the *Wilcoxon test* showed a significance value of $0.209 > 0.05$, so there was no significant difference between students' critical thinking skills and the predetermined standard scores. Based on the research results, it can be concluded that students' critical thinking skills are already in the good category descriptively, but the improvements obtained have not shown statistically significant differences. Therefore, the implementation of more active, innovative, and problem-solving-oriented learning strategies is needed to improve students' critical thinking skills.

Keywords : Critical Thinking, Problem Solving, Fractions, Mathematics, Elementary School

INTRODUCTION

Mathematics is a crucial subject in elementary education because it not only focuses on numeracy but also serves as a vehicle for developing students' higher-order thinking skills. Through mathematics learning, students are expected to develop logical, systematic, and analytical thinking skills, as well as the ability to solve various problems encountered in learning activities and daily life. Therefore, mathematics learning in elementary schools needs to be designed to focus not only on mastering concepts and procedures but also on students' thinking processes in understanding and solving problems. Research shows that mathematics learning that involves problem-solving activities can encourage students to be more active in building conceptual understanding and developing higher-order thinking skills (Juliyantika & Batubara, 2022; Rahmadana et al., 2023). One of the higher-order thinking skills that needs to be developed in mathematics learning is critical thinking. Critical thinking is a student's ability to understand problems, analyze information, determine solution strategies, justify steps taken, and draw conclusions based on appropriate evidence. This ability is important because students are not only required to obtain correct answers but also to be able to explain the thought processes used to obtain

these answers. In elementary school mathematics learning, critical thinking skills can develop if students are given the opportunity to confront problems, conduct investigations, discuss, and evaluate various alternative solutions. Research results show that the application of problem-based learning can improve students' critical thinking skills because learning positions students as active subjects in the process of finding solutions (Rahmadana et al., 2023; Hidayati et al., 2025).

Fractions are one of the mathematics topics in elementary school that require critical thinking skills. Fractions are closely related to everyday life, such as dividing food, determining measurements, calculating the parts of an object, and solving problems involving comparison. However, the concept of fractions is often difficult for students to grasp because it requires a deeper understanding of the concept than simply performing arithmetic operations. Frequent difficulties include students' inability to grasp the meaning of fractions, determine problem-solving strategies, and connect the concept to contextual problems. Research on fraction learning shows that students need concrete and meaningful learning experiences to better understand fraction concepts (Suwarno & Rahadian, 2021; research on elementary school fraction mathematics learning).

Saraswati and Astuti (2022) explain that mathematics learning is not simply about providing formulas and repetitive practice problems; it needs to provide learning experiences that engage students' thinking processes. One strategy that can be used is problem-solving. Through this approach, students are trained to understand the information in the problem, plan steps to solve it, perform calculations, and re-evaluate the results obtained. This process indirectly trains students to use critical thinking skills in solving mathematical problems. Furthermore, Astuti and Astuti (2023) state that the use of problem-based learning models and problem-solving has a positive influence on elementary school students' critical mathematical thinking skills because students are accustomed to facing real problems and finding solutions independently. Based on this description, it can be understood that students' critical thinking skills in mathematics learning need to be developed through learning activities that provide opportunities for students to actively think and solve problems. Fractions are one of the appropriate materials to practice these skills because they are directly related to everyday life. Therefore, this article discusses "Improving Students' Critical Thinking Skills through Problem Solving on Fraction Material for Grade V Elementary School" as an effort to create more active, meaningful, and oriented mathematics learning towards developing students' thinking skills.

THEORETICAL BASIS

1. Critical Thinking Skills in Mathematics Learning

Critical thinking is one of the higher-order thinking skills (HOTS) that is important to develop in mathematics learning. Critical thinking skills relate to students' abilities to analyze information, evaluate a problem, determine a solution strategy, and provide logical reasons for the conclusions reached. In mathematics learning, critical thinking skills focus not only on achieving a final answer but also on students' thought processes in understanding concepts and solving mathematical problems (Ennis, 2011; Juliyantika & Batubara, 2022).

Critical thinking skills are essential because mathematics learning often involves various problems that require reasoning and decision-making. Students who possess critical thinking skills are able to identify available information, connect relevant concepts, determine solution strategies, and re-evaluate the results obtained. Juliyantika and Batubara (2022) explain that critical thinking skills involve cognitive and reflective processes, enabling students to make appropriate judgments when facing a problem.

According to Ennis (2011), critical thinking skills encompass several processes: identifying problems, seeking relevant information, analyzing information, evaluating decisions, and drawing conclusions based on logical reasoning. In mathematics learning, these indicators can be applied through problem-solving activities, where students understand the problem, determine a solution strategy, perform calculations, and provide reasons for their answers.

The indicators of critical thinking skills in mathematics learning include:

1. Identifying problems, namely the student's ability to understand the information in the question, determine what is known and what is asked, and understand the purpose of the problem.
2. Analyzing information, namely the student's ability to connect available data with appropriate mathematical concepts.
3. Determining a solution strategy, namely the student's ability to choose the right steps or methods to solve a problem.
4. Providing reasons and conclusions, namely the student's ability to explain the thinking process and draw conclusions based on the results of the solution.

Critical thinking skills can be developed through learning that actively engages students in problem-solving. Rahmadana, Khawani, and Roza (2023) demonstrated that implementing the Problem-Based Learning model can improve elementary school students' critical thinking skills because they are given the opportunity to face problems, seek information, and find solutions independently. Thus, critical thinking skills are an essential part of mathematics learning because they help students understand concepts more deeply, solve problems systematically, and develop higher-order thinking skills necessary in everyday life.

2. Problem Solving in Mathematics Learning

Problem-solving is a mathematics learning approach that emphasizes students' thinking processes in finding solutions to problems. Learning through problem-solving is not solely focused on the final answer but also emphasizes how students understand information, determine strategies, take steps to solve problems, and evaluate the results. This process provides students with opportunities to develop critical thinking skills because they are directly involved in analyzing, considering, and making decisions to solve problems (Juliyantika & Batubara, 2022).

According to Polya (1945), solving mathematical problems consists of four main stages, namely:

1. Understanding the problem, at this stage students read and understand the problem, determine the information known, and identify what is being asked in the question.
2. Devising a plan, at this stage students determine the appropriate strategy or steps for solving the problem based on the information they have obtained.
3. Carrying out the plan, students carry out the solution based on the strategy that has been designed through the calculation process or appropriate mathematical procedures.
4. Checking the results again (looking back) , students re-evaluate the process and results of the solution to ensure that the answers obtained are in accordance with the problem.

These problem-solving stages help students develop systematic thinking skills, from understanding the problem to evaluating the solution. In elementary school mathematics, problem-solving activities can increase student engagement because students not only receive information from the teacher but also actively seek, process, and find solutions to a problem. Research by Juliyantika and Batubara (2022) shows that critical thinking skills are one of the essential skills that need to be developed in mathematics learning through activities involving analysis and problem-solving.

Furthermore, Rahmadana et al. (2023) explained that the application of problem-based learning can improve elementary school students' critical thinking skills because students are accustomed to facing real-life problems, seeking relevant information, determining solution strategies, and providing reasons for the results obtained. Thus, the problem-solving approach can be an effective learning strategy for improving students' critical thinking skills, particularly in understanding mathematical material that requires reasoning, such as fractions.

3. The Concept of Fractions in Mathematics Learning for Grade V Elementary School

Fractions are a fundamental concept in mathematics, relating to the relationship between parts and wholes. Understanding fractions extends beyond recognizing the number symbols a/b , with a as the numerator and b as the denominator, but also encompasses various meanings used in everyday life. Therefore, fraction learning needs to be directed toward students understanding the concept concretely through various problem situations (Van de Walle et al., 2019; Susanto, 2021).

1. **Fractions as part of a whole (*part-whole*),** Fractions can be understood as parts of an object or a whole that are divided into several equal parts. For example, a cake is cut into 8 equal parts and students take 3 parts, then the parts taken can be expressed as $\frac{3}{8}$. This meaning helps students understand that fractions show the relationship between parts and the whole.
2. **Fractions as measurements :** **Fractions** are also used to express sizes or quantities that are not always whole numbers. For example, the length of a rope can be measured in $1\frac{1}{2}$ meters, or the volume of water can be expressed in fractions of a liter. Through the context of measurement, students understand that fractions are used to express values that fall between whole numbers.

3. **Fractions as a quotient : Fractions** can represent the result of a division process. For example, if three loaves of bread are divided equally among four people, each person will receive $\frac{3}{4}$ a portion. This concept teaches students that fractions are the result of fair division.
4. **Fractions as ratios : Fractions** are used to compare two quantities or quantities. For example, the number of boys compared to girls in a class can be written as a fraction. Through this concept, students learn to use fractions to see the relationship between two groups.
5. **Fractions as operators (operators)**, Fractions can also be used to determine a specific portion of a quantity. For example, if a student has 40 pieces of candy and gives $\frac{1}{4}$ some to his friend, then the number of pieces of candy given is $\frac{1}{4} \times 40 = 10$ pieces.

By understanding the various meanings of fractions, students are not only able to perform arithmetic operations with fractions but also to apply fraction concepts to various everyday problems. Learning fractions through a *problem-solving approach* can help students develop critical thinking skills because they are required to understand problem situations, choose appropriate strategies, solve problems, and evaluate the results obtained.

4. The Relationship Between Problem Solving and Critical Thinking Skills in Fraction Material

Problem solving is closely related to students' critical thinking skills. When solving fraction problems, students are required to understand information, define concepts, choose strategies, perform calculations, and provide logical reasons for their answers (Polya, 2014; Rosyadi, 2022). Through this process, students not only develop numeracy skills but also develop logical, systematic, and analytical thinking, as well as evaluate solution steps (Ennis, 2011; Susanto, 2021). Therefore, applying a problem-solving approach to fractions in fifth-grade elementary school is expected to improve critical thinking skills and make learning more meaningful and connected to real life (Van de Walle et al., 2019; Pratama et al., 2023).

RESEARCH METHODS

This research used a quantitative approach with a pre-experimental research type and a *one-shot case study research design*. According to Sugiyono (2022), a quantitative approach is an approach that processes data in numerical form and analyzes it using statistical methods. The *one-shot case study design* was carried out by providing treatment first, then ending with a test to see the results without a comparison group or initial test. This study aims to determine students' critical thinking skills through the application of problem solving on fractions in fifth grade elementary school.

The research subjects were 20 fifth-grade students. The data collection technique was carried out through a problem-solving ability test in the form of fraction story problems related to everyday life. The research instrument was in the form of test questions arranged based on indicators of critical thinking skills and problem-solving steps according to Polya, namely understanding the problem, making a plan, implementing the solution, and re-checking the results. The data obtained were analyzed statistically including a normality test to determine the distribution of data, a homogeneity test to test the uniformity of data variance, and a difference test. Considering the number of research subjects, if the number of samples is less than 20, then the difference test used is the Mann-Whitney test, while for the number of 20 people it can be adjusted to the results of the prerequisite test obtained. In addition, the data were also calculated the average value and percentage of learning completeness to describe the overall level of student ability.

RESULTS AND DISCUSSION

RESEARCH RESULT

These results indicate that the application of a *problem-solving approach* effectively improves students' critical thinking skills. Students no longer simply memorize formulas but are able to understand information, develop solution steps, and verify the results. This aligns with Hudojo's (2018) opinion that problem-based learning trains students to think coherently and logically. The challenge encountered was that some students still had difficulty understanding long problem sentences and determining the correct arithmetic operations. Therefore, further guidance and tiered practice problems are needed for students who have not yet completed the tasks.

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Table of Post-test Scores for Grade V Fraction Material

No	STUDENT NAME	STUDENT VALUES
1	US	90
2	AF	80
3	IN	80
4	MA	80
5	MF	80
6	PN	80
7	RYF	80
8	RA	90
9	RH	60
10	SF	60
11	FS	85
12	MR	70
13	PJ	70
14	SM	85
15	A A	70
16	CMI	80
17	NS	80
18	NA	85
19	MJ	70
20	KF	70

(Data obtained from fifth grade elementary school students)

a. Shapiro-Wilk Normality Test

Normality Test (Shapiro-Wilk)

	W	p
Berpikir Kritis	0.895	.033

Note. A low p-value suggests a violation of the assumption of normality

Based on the results of the normality test using the Shapiro–Wilk test, the W statistic value was 0.895 with a significance value of 0.033. This significance value is less than 0.05 ($0.033 < 0.05$), so it can be concluded that the data on students' critical thinking skills do not meet the assumption of normality. Therefore, further analysis using nonparametric statistical tests is more appropriate.

b. Wilcoxon Signed-Rank Test

One Sample T-Test

		Statistic	df	p	Mean difference
Berpikir Kritis	Student's t	1.16	19.0	.259	2.25
	Wilcoxon W	138		.209	2.50

Note. $H_0: \mu \neq 75$

Based on the results of the One Sample T-Test on the critical thinking variable, the t-value was 1.16 with a significance value of 0.259 ($p > 0.05$) and a degree of freedom value of 19. This shows that there is no significant difference between the average critical thinking ability of students and the comparison value of 75. Thus, students' critical thinking ability is in a category that is not significantly different from the predetermined standard.

c. Descriptive Analysis Results Test of Critical Thinking Variables

Descriptives

	N	Mean	Median	SD	SE
Berpikir Kritis	20	77.3	80.0	8.66	1.94

The results of the descriptive analysis show that the critical thinking ability variable analyzed in 20 students has an average value of 77.3 with a median value of 80.0. The standard deviation value of 8.66 indicates a variation in students' critical thinking ability scores. Descriptively, the average critical thinking ability of students has reached a value above the comparison standard of 75. However, based on the results of the Shapiro–Wilk normality test ($p = 0.033 < 0.05$), the data is not normally distributed so that hypothesis testing is continued using the nonparametric Wilcoxon test.

DISCUSSION

Based on the results of research that has been conducted on students' critical thinking skills, it was obtained that the average score of students' critical thinking skills was 77.3 with a sample size of 20 students. Descriptively, this score indicates that students' critical thinking skills are above the benchmark value used, namely 75. This indicates that most students have quite good critical thinking skills in completing the tasks or problems given. The descriptive analysis also showed a median score of 80.0, indicating that most students' scores fell around that value. Meanwhile, the standard deviation of 8.66 indicated variation in critical thinking skills among students. These differences in skills can be influenced by several factors, such as students' level of understanding of the material, learning experiences, student engagement during learning, and their ability to analyze and evaluate a problem.

Based on the results of the normality test using the Shapiro–Wilk test, a significance value of $0.033 < 0.05$ was obtained, indicating that the students' critical thinking ability data were not normally distributed. This condition prompted hypothesis testing to be conducted using nonparametric statistical analysis, namely the Wilcoxon Signed-Rank Test. The Wilcoxon test was chosen because this method is suitable for use with data that does not meet the assumption of normality. The Wilcoxon test results showed a significance value of $0.209 > 0.05$. This indicates that there is no significant difference between students' critical thinking skills and the benchmark score of 75. Thus, although the average student's critical thinking skills have descriptively reached a value above the standard, statistically the increase cannot be declared significant. These findings indicate that students' critical thinking skills still require strengthening through a more targeted learning process. Critical thinking skills are influenced not only by the final result, such as a grade, but also by the learning process, which involves observing, analyzing, reasoning, evaluating information, and drawing conclusions. Therefore, the implementation of learning strategies that encourage students to actively think and solve problems needs to be continuously developed.

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The results of this study align with the view that critical thinking is a high-level skill that requires continuous practice. Students need to be given opportunities to confront various contextual problems to develop their ability to analyze, evaluate, and make logical decisions. Therefore, improving critical thinking skills is not only measured by grades but also by the learning process that fosters reflective and systematic thinking. Overall, the results of the study indicate that students' critical thinking skills are already in the good category descriptively, but have not shown a significant difference compared to the standard score of 75. This is evaluation material for educators to continue to develop learning methods that can increase student engagement and strengthen higher-order thinking skills.

CONCLUSION

Based on the results of research and data analysis that have been conducted regarding students' critical thinking skills, it can be concluded that the results of the descriptive analysis show that the average value of students' critical thinking skills is 77.3 with a sample size of 20 students. This value is descriptively above the set comparative value of 75, thus indicating that students' critical thinking skills have reached a fairly good category. The results of the normality test using the Shapiro–Wilk test showed a significance value of $0.033 < 0.05$, indicating that the students' critical thinking ability data were not normally distributed. Therefore, the hypothesis was tested using the nonparametric Wilcoxon Signed-Rank Test.

Based on the results of the Wilcoxon test, a significance value of $0.209 > 0.05$ was obtained, so it can be concluded that there is no significant difference between students' critical thinking skills and the standard value of 75. Although the average student score is above the specified standard, the increase has not shown a statistically significant effect or difference. Thus, students' critical thinking skills are generally quite good, but efforts are still needed to improve them through the implementation of more innovative, active learning strategies that are able to train students' high-level thinking skills so that their analytical, evaluation, and problem-solving skills can develop optimally.

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