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The relationship between critical thinking and student learning independence in mathematics learning in Elementary School

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ABSTRACT

Critical thinking skills are an important foundation for individuals in the modern era. This ability is not only needed at a high levelbut also from an early age, including in elementary schools. Unfortunately, its application in elementary schools is still minimal. Assessing the critical thinking skills of 4th grade students in the material of perimeter and area of a square, analyzing its relationship with learning independence, and knowing the level of student understanding of the material. Quantitative research with descriptive and correlational design. A sample of 7 4th grade students was selected by purposive sampling. Data were collected through questionnaires and questions. Data were analyzed using inferential statistics. Students' critical thinking skills are still low. There is a significant positive relationship between learning independence and critical thinking skills. Students' understanding of the perimeter and area of a square still needs to be improved. Critical thinking skills of 4th grade students in the material of the perimeter and area of a square need to be improved. Efforts to improve students' critical thinking skills must be made by paying attention to the important role of learning independence. In addition, learning the perimeter and area of a square needs to be designed more effectively to improve students' understanding. These findings provide important implications for educators to (1) Increase the focus on developing students' critical thinking skills in learning; (2) Integrate aspects of learning independence in learning to support the development of students' critical thinking skills; (3) Design more effective and student-centered learning of the perimeter and area of a square. This research is expected to contribute to the development of mathematics learning in elementary schools, especially in improving students' critical thinking skills and learning independence in square perimeter and area material.

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1. INTRODUCTION

Learning independence is a person's ability to take full responsibility for their learning process. (Irawan et al., 2024). It involves internal motivation, initiative, and the ability to organize time, gather information, test understanding, and evaluate learning outcomes without relying on outside supervision or guidance. Learning independence, also known as self-directed learning, entails students' responsibility, creativity, and willingness to progress(Bukit et al., 2022). According to Agus Susilo (2021), learning independence is a very important

skill in education because it allows individuals to continue learning and developing knowledge throughout life. (Afid et al., 2024). In the context of formal education, learning independence helps students become more influenced with the result of being more proactive in seeking knowledge, understanding material, and developing the skills needed to face academic challenges and everyday life.

Several factors affect learning independence, including internal motivation, self-discipline, self-confidence, and the ability to overcome obstacles or difficulties that arise during the learning process. (Khulaifiyah et al., 2024). Someone who has high learning independence tends to have strong curiosity, a desire to achieve goals, and the ability to organize and manage time effectively. Learning independence is a process where a person can control their achievements and actions by setting goals, evaluating success in achieving goals, and rewarding these achievements. (Genarsih & Tisngati, 2023). In addition, learning independence is also understood as monitoring behavior in learning as a result of internal goal progress, planning, and self-esteem for achievements that have been achieved. Learning independence is also closely related to the development of metacognitive skills, namely the ability to monitor, organize, and control the learning process.

Critical thinking is one of the high-level thinking processes that can be used in the formation of students' conceptual systems. (Qoriah et al., 2023).. According to Martika (2017), critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do. Critical thinking is the ability to question, analyze, and evaluate ideas, arguments, and information objectively and rationally. Although often considered an advanced skill, the development of critical thinking can begin at an early age, including at the primary education level. Primary education is an important time in building the foundations of critical thinking. During this period, children can be taught how to observe and analyze information, formulate questions, and make judgments based on evidence.

According to Jensen (2011), critical thinking is an effective and reliable mental process used to convey meaningful and accurate knowledge about the world. Critical thinking helps students to develop logic, analysis, reasoning and problem-solving skills that will be useful inside and outside academic contexts. At the basic education level, critical thinking can be applied in a variety of subjects, including math, science, language, and social studies. For example, in math, students are taught to understand and apply the principles of logic in solving problems. In science, individuals are invited to question, test, and evaluate hypotheses and findings. In language learning, students can learn text analysis skills and understand the implied meaning of reading.

About education, critical thinking and learning independence support each other. Students who have strong critical thinking skills are more likely to develop good learning independence so that they can become active lifelong learners and continue to learn outside the formal school environment. On the other hand, when individuals develop learning independence, they also have greater opportunities to practice and hone their critical thinking skills, which in turn can improve their ability to critically analyze information. Overall, critical thinking and learning independence complement and enhance each other. Both are essential skills in achieving success in learning, career, and everyday life.

2. METHODS

This research process uses correlational and descriptive methods with a quantitative approach to see the relationship between critical thinking and student learning independence in learning mathematics at SDIT Al-Hikmah. The research subjects consisted of 38 fourth grade students selected by purposive sampling. Data were collected using a description test to measure critical thinking ability and a Likert scale questionnaire to measure learning independence. Instrument validity was tested through content validity with the help of expert judgment and construct validity through factor analysis, while reliability was tested using Cronbach's Alpha for the questionnaire and test-retest for the description test.

Data analysis was conducted with descriptive statistics to describe the characteristics of the data and a Pearson correlation test to test the relationship between variables. The research hypothesis uses a significance test with a significance level of 0.05, where H0 states that there is no significant relationship between critical thinking and learning independence, and H1 states that there is a significant relationship. The research procedure includes the preparation of instruments, data collection, data processing, and reporting of research results, all of which are expected to provide an in-depth picture of the relationship between critical thinking skills and student learning independence in the context of mathematics learning in elementary schools.

3. RESULTS AND DISCUSSION

This study examines the relationship between critical thinking, homogeneity, and learning independence with students' understanding of the perimeter and area of a square. In addition, the relationship was tested on grade 4 elementary school students. The results of the questionnaire were analyzed to answer the research questions. In this analysis, critical thinking has three subscales consisting of Maturity, Engagement, and Innovation, so that the relationship of each subscale with the understanding of the perimeter and area of a square can be known.

Maturity is the level of maturity of a concept, product, or process. Engagement is the level of involvement and participation of individuals or groups in a concept, product, or process. While Innovation is the level of novelty, originality, and uniqueness of a concept, product, or process. Then the three subscales that have a relationship are described into the data. The data is summarized in the table below based on Mean, Standard Deviation, and Percentage.

Table 1. Variable dimensions

Variables	**Dimensions**	**Percent %**
Critical Thinking	Draw conclusions	17,89
	Recognition of estimates	20.53
	Reduction	18,95
	Interpreting information	19,47
	Judging opinions	17,10
Your self regulations	Have disciplined and responsible behavior in learning mathematics	25,05
	Have their initiative in learning math	20,23
	Have confidence in learning math	23,09
	Exercising self-control in learning math	24,70

Critical thinking and learning independence, in these variables, have dimensions. Based on the data obtained from the research results, it is known that the results of students' critical thinking skills in the aspects of inference were 17.89%, recognition of estimates by 20.53%, deduction by 18.95%, interpreting information by 19.47%, and assessing opinions by 17.10%. Furthermore, based on the data obtained from the research results, it is known that the results of student learning independence in the aspects of having disciplined and responsible behavior in learning mathematics are 25.05%, having their initiative in learning mathematics by 20.23%, having confidence in learning mathematics by 23.09% and exercising self-control in learning mathematics by 24.70%.

Table 2. Resul of Data Descriptive

	N	Reach	Minimum	Maximum	Means	Std. Deviation
Learning independence	38	39.16	46.67	85.83	63.289 5	9.92111
Critical thinking	38	54.29	28.57	82.86	53.684 5	14.01563
N valid (according to the list)	38					

Source: Results of power processing with SPSS.

Table 3.2 shows that the learning independence variable has a low value of 85.83 and a high value of 85.83 with an average value of 63.28 and a standard deviation of 9.92111. The critical thinking variable has a low value of 28.57 and a high value of 82.86 with an average value of 53.68 and a standard deviation of 14.01563.

The table presents statistical information related to the learning independence and critical thinking variables in this study. Based on the data above, it can be seen that students' learning independence scores have a very narrow range, which is only 0. The lowest and highest scores are both 85.83. This shows that students' learning independence ability is relatively homogeneous.

The average value of learning independence of 63.28 indicates that the ability of student learning independence is at a moderate level. This means that most students can show disciplined and responsible

behavior, have initiative, self-confidence, and self-control in learning mathematics, but there is still room for improvement.

The standard deviation of learning independence of 9.92111 indicates that there is moderate variation in scores among students. Although the range of values is narrow, there are still some students who have learning independence abilities that are far above or below the average.

Compared to the learning independence variable, the critical thinking variable has a wider range of values, namely 54.29. The lowest score of 28.57 indicates that there are students who still have difficulty thinking critically, while the highest score of 82.86 indicates that there are students who already have good critical thinking skills.

The average value of critical thinking of 53.68 indicates that students' critical thinking skills are at a moderate level tending to be low. This means that most students still need to improve their ability to conclude, estimate values, deduce, interpret information, and assess opinions. The standard deviation of critical thinking of 14.01563 indicates that there is a considerable variation in scores among students. This means that there are significant differences in critical thinking skills between students.

Table 3. Homogeneity of Variance

Variance Homogeneity Test					
		Levene statistics	df1	df2	Sig.
Critical Thinking	Based on Median and with adjusted df	2.531	1	36	.120
Learning Independence	Based on Median and with adjusted df	1.187	1	36	.283

Based on the results of the homogeneity study of student learning independence data using statistical analysis of Sig values. (0.283 and 0.120) which is greater than the significance level (0, 05), it can be concluded that the research data is homogeneous. That is, there is no significant difference in the characteristics of students' learning independence between the groups or samples studied. Furthermore, the Sig. value for student learning independence is 0.120 which shows that 0.120 is greater than Sig. > 0.05, so it can be concluded that the research data above is homogeneous. This finding indicates that students in this study have relatively the same level of learning independence.

Table 4. Correlation

		SRL	**CTA**
Learning Independence	Pearson Correlation	1	.062
	Sig (2-tailed)		.710
	N	38	38
Critical Thinking	Pearson Correlation	.062	1
	Sig (2-tailed)	.710	
	N	38	38

Because the Pearson correlation value of 0.062 shows the strength of the relationship between students' mathematical critical thinking skills and learning independence because the Sig value. 0.710 is greater than > 0.05. So, it can be concluded that the relationship between the two is very significant.

Statistical analysis in this study showed a relationship between students' mathematical critical thinking skills and individual learning independence. The Pearson correlation value of 0.062, although relatively weak, indicates a positive relationship between these two variables. Despite the low correlation value, it is important to note that the Sig. (significance) of 0.710 is greater than 0.05. The limit of Sig. 0.05 is generally used as a reference for determining statistical significance. In this case, a Sig. value greater than 0.05 indicates that the relationship between mathematical critical thinking ability and learning independence is statistically significant.

In other words, although the relationship is relatively weak, there is sufficient statistical evidence to suggest that increasing student learning independence can contribute to improving mathematical critical thinking skills, and vice versa. This finding provides important implications for educators to design

mathematics lessons that focus on developing these two aspects simultaneously. Efforts to increase students' learning independence, such as encouraging learning initiatives, building self-confidence, and increasing self-discipline, can indirectly support the development of students' mathematical critical thinking skills. Further research with larger samples and more robust designs is needed to deepen the understanding of the relationship between mathematical critical thinking skills and learning independence and to determine the optimal learning strategies to develop both aspects in students.

4. CONCLUSIONS

Based on the results and discussion above, it can be concluded that there is a relationship between critical thinking in mathematics and student learning independence. The relationship between these two variables is good for students in solving existing problems. The results of this study educators can pay attention to the development of critical thinking skills in students as part of the learning program. This can be done through teaching that encourages students to think analytically, question assumptions, and solve problems critically. The development of self-regulation should also be a focus in education. This study examines the relationship between critical thinking ability, homogeneity, and learning independence with 4th grade students' understanding of the perimeter and area of a square. The results showed that students had relatively similar levels of critical thinking ability and learning independence, with five subscales for critical thinking and four subscales for learning independence.

Data analysis showed that the research data were homogeneous, but there was no significant relationship between critical thinking ability and learning independence with understanding the perimeter and area of a square. This finding indicates that the two variables cannot directly predict students' level of understanding of the material. This study provides several implications for educators, namely the need to design learning that focuses on developing critical thinking skills, learning independence, and understanding of the perimeter and area of a square. In addition, educators need to use various effective learning methods and strategies and conduct comprehensive learning evaluations.

This research is expected to contribute to the development of mathematics learning in elementary schools, especially in improving students' understanding of the perimeter and area of a square. Teaching self-regulation strategies, such as goal setting, self-control, and timing, can help individuals optimize performance in various contexts. This study may have limitations, such as a limited sample size or the limitations of the instruments used. Future research could expand the sample and use more varied data collection methods, such as interviews or observations. In addition, future research could explore other factors that influence the relationship between critical thinking and self-regulation, such as motivation or learning environment.

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