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Analysis of Critical Thinking, Creative Thinking and Problem Solving Skills on Elementary School Students: A Descriptive Correlation Study

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Abstract: The 21st-century competencies have become a primary focus for enhancing human resource capacity in Indonesia. The 21st-century competencies refer to a set of skills necessary for development in the modern era. These competencies include creative thinking, critical thinking and problem solving, communication, and collaboration, collectively known as the 4C skills. The 4C skills of students in Indonesia tend to be low. Based on the observations and interviews conducted by the author with teachers and students in several schools in Padang City, it was found that the majority of students did not achieve mastery in mathematics learning. They struggled to solve the mathematical problems presented to them. This research aims to analyze the relationship between critical and creative thinking skills toward problem-solving abilities of elementary school students in Padang City. This is correlational descriptive research. The study was conducted on fifth-grade students at SD 22 Kampung Dalam Padang. A random sample of 127 students was taken. The instruments used included a questionnaire for critical thinking skills, a questionnaire for creative thinking skills, and an essay test on problem-solving abilities. Data were analyzed descriptively, quantitatively, and inferentially. The results of the data analysis indicated that there was a significant relationship between critical and creative thinking skills toward students' problem-solving abilities.

Keywords: critical, creative and problem-solving skill, mathematics.

▪ INTRODUCTION

The 21st-century competencies are the main focus for improving human resources capacity in Indonesia. This is in line with the idea of (Graesser et al., 2022), who stated that 21st-century skills "include self-regulated learning, independent learning, collaborative problem-solving, communication, and other competencies. The 4C abilities (critical thinking, creativity, collaboration, and communication) of students in Indonesia tend to be still low (OECD, 2023). The 4C skills (Critical thinking, Creativity, Communication, and Collaboration) are fundamental or intellectual assets that are crucial for everyone in the global era. However, the results of the 2023 Program for International Student Assessment (PISA) showeded that Indonesian students' critical thinking and creativity still needed improvement. Based on the observations and interviews conducted by the author with teachers and students at several schools in Padang, it was found that most students did not achieve mastery in mathematics learning. They struggled to understand and solve the given math problems. While some students understood the material, they were unable to solve the problems correctly, showing a lack of critical thinking and creativity in generating new ideas from what the teacher presented.

Creative and critical thinking skills are considered essential for students (Baker et al., 2001). Creative and critical thinking complement each other and result in quality innovation and the sustainability of education (Birgili, 2015). The competencies of creative and critical thinking are inherent potentials within students, but they require

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encouragement from their environment to hone these abilities (Fitriya et al., 2022). Each individual has a unique way of developing their potential, making them distinct from one another. This uniqueness is what makes critical and creative thinking a crucial aspect of active student engagement in learning. These differences also influence the impact on each student during the learning process.

Essentially, creative thinking relates to one's ability to create or produce something new (Amrina et al., 2020). Critical thinking helps students differentiate between facts and opinions, enabling them to make wise decisions. With critical and creative thinking skills, students can find solutions to problems encountered in learning mathematics. Therefore, critical and creative thinking competencies can also be seen as mental activities used to solve problems, present new ideas or views on existing problems or ideas. Problem-solving skills are essential for every student because (a) problem-solving is the general goal of mathematics instruction, (b) problem-solving, which includes methods, procedures, and strategies, is the core and main process in the mathematics curriculum, and (c) problem-solving is a fundamental skill in learning mathematics (Branca, 1980). Similarly, (Rukmana Yus et al., 2019) state that mathematics needs to be taught to students because it serves several purposes: (a) it is used in all aspects of life, (b) all fields of study require mathematical skills, (c) it provides a strong, concise, and clear means of communication, (d) it can be used to present information in various ways, (e) it enhances logical, critical, and consistent thinking, and (f) it offers satisfaction in solving challenging problems.

Critical thinking means thinking correctly in the pursuit of relevant and reliable knowledge about the world. Another way to describe it is as reasonable, reflective, responsible, and skilled thinking focused on deciding what to believe or do (Schafersman, 2008). According to Krulik & Rudnick, critical thinking has several components: (a) Basic operations of reasoning: To think critically, one must have the ability to explain, generalize, draw deductive conclusions, and formulate other logical steps mentally, (b) Domain-specific knowledge: When facing a problem, one must have knowledge about the topic or content, (c) Metacognitive knowledge: Effective critical thinking requires an individual to monitor when trying to truly understand an idea, recognize when they need new information, and figure out how they can easily gather and learn that information, (d) Values, beliefs, and dispositions: Critical thinking involves making fair and objective judgments (Abdullah et al., 2014). According to Ennis (Bermingham, 2015), six indicators can be used to measure someone's critical thinking skills: Focus, Reason, Inference, Situation, Clarity, and Overview.

The next competency is creative thinking. Creative thinking can be defined as the entire range of cognitive activities used by individuals according to objects, problems, and specific conditions or types of events and issues based on individual capacity (Birgili, 2015). Creative thinking is a divergent thinking process, which is the ability to provide various alternative answers based on the given information. The most important characteristics of creative (divergent) thinking are: (1) Fluency, the ability to generate many ideas. Fluency emphasizes quantity rather than quality, (2) Flexibility, the ability to propose various approaches and/or solutions to problems, (3) Elaboration, the ability to detail something extensively, (4) Originality, the ability to propose unique (unusual) ideas or to come up with original ideas as a result of one's own thinking (Hendrizal, 2015). These characteristics are used as indicators to determine students' creative thinking skills.

In the educational environment, problem-solving, a skill closely related to critical thinking, is expected to be acquired by students and is often encountered in both mathematics and real life (Üredi & Kösece, 2020). The problem-solving indicators used as a reference in assessing students' problem-solving skills are Polya's indicators, which consist of understanding the problem, devising a solution plan, executing the plan, and reviewing the solution results (Sari et al., 2024), (Fahrudin et al., 2019).

Research on critical thinking skills, creative thinking, and problem-solving skills has been widely conducted by researchers. Some of them are (Wilkie, 2024), (Yildiz & Guler Yildiz, 2021), (Suherman & Vidákovich, 2024), (Boso et al., 2021), (Amrina et al., 2022) and others. These researchers only discuss how one of these skills is formed and the relationship between two of the three skills. The researcher believes that there is a need for a study that addresses all three skills. Therefore, this research is worth conducting to answer that question.

▪ METHOD

This study aims to describe the critical thinking skills, creative thinking skills, and problem-solving abilities of elementary school students, as well as to analyze the relationship between these three skills. The research design used is descriptive correlational design. Data collection for critical and creative thinking skills was done through questionnaires, while problem-solving ability was measured using tests. The population of this study consists of 127 fifth-grade students from SD 22 Kampung Dalam Padang, divided into 5 classes. The entire population was used as the sample, (total sampling technique). There are two variables in this study: the independent variables, which are critical thinking skills and creative thinking skills, and the dependent variable, which is problem-solving ability.

The instruments used in this research were a questionnaire to measure critical and creative thinking skills, and a test to assess students' problem-solving abilities. The questionnaire used to measure critical and creative thinking was developed by (Amrina et al., 2018) and consists of 30 items: 15 for critical thinking and 15 for creative thinking. The questionnaire has been validated with a validation index of 90% (very high) and a reliability index of 0.86, which is considered high. This indicates that the questionnaire is valid and reliable. The indicators for the critical thinking skills questionnaire are: **Focus:** Students are able to focus on the problem or question and determine the concepts needed to solve the problem. **Reason:** Students can provide reasons for the answers they give. **Inference:** Students can draw conclusions based on the reasons they have provided by outlining the steps in the solution. **Situation:** Students can answer questions in context, use mathematical language, and solve application problems. **Clarity:** Students can provide further clarity, either in definitions or conceptual relationships. **Overview:** Students can review what has been found, decided, considered, learned, and concluded. Meanwhile. The indicators for the creative thinking skills questionnaire are: **Fluency:** The ability to generate many ideas. **Flexibility:** The ability to use various approaches in solving problems. **Originality:** The ability to produce original ideas; d. Elaboration: The ability to express ideas in detail; e. Sensitivity: The ability to capture and generate ideas in response to a situation. (Amrina et al., 2018). To measure students' problem-solving abilities, a test consisting of 4 essay questions was used. The test indicators include understanding the problem, planning the solution, executing the solution, and reviewing the result. The collected data was analyzed using descriptive and inferential analysis.

Descriptive analysis was used to describe the data collected, including average scores, variance, standard deviation, and score ranges. The inferential analysis used is linear regression analysis.

▪ RESULT AND DISSCUSSION

After the data was obtained, the next step was to conduct a descriptive, quantitative, and inferential data analysis.

Descriptive Analysis

Based on the results of the data analysis, it can be presented in the following table:

Descriptives			
	Critical Thinking	**Creative Thinking**	**Problem solving**
N	127	127	127
Mean	11.5	11.0	80.5
Median	11	11	82
Standard deviation	2.46	2.26	14.6
Minimum	6	7	38
Maximum	15	15	98

Based on the results of descriptive analysis for the variables of critical thinking, creative thinking, and problem-solving skills, information obtained on a comprehensive overview of students' abilities can be explained as follows:

Descriptive Analysis of Critical Thinking Skills in Elementary School Students

For the critical thinking variable, with 127 student respondents, the average score obtained was 11.5, indicating that overall, students had a fairly good level of critical thinking skills. The median score of 11 showed that half of the students had critical thinking skills either below or above this value, reflecting a relatively even distribution. A standard deviation of 2.46 indicates moderate variation in critical thinking abilities among students, with a minimum score of 6 and a maximum of 15. This range suggests a significant difference between students with the lowest and highest critical thinking abilities.

Descriptive Analysis of Creative Thinking Skills in Elementary School Students

For the creative thinking variable, with the same number of respondents, the average score was 11.0, indicating that students' creative thinking skills were at a fairly good level, though slightly lower than critical thinking. The median score for creative thinking was 11, reflecting a balanced distribution among students. A standard deviation of 2.26 shows relatively low variation in creative thinking abilities, with a minimum score of 7 and a maximum of 15. This suggests that, although there is variation, students' creative thinking abilities tend to be more consistent.

Descriptive Analysis of Problem-Solving Skills in Elementary School Students

For the problem-solving skills variable, the average score was 80.5, indicating that students overall have excellent problem-solving abilities. The median score for problem-solving was 82, meaning that half of the students performed above this score, reflecting a higher distribution compared to the previous two variables. A standard deviation of 14.6 indicates greater variation in problem-solving abilities among students, with a minimum score of 38 and a maximum of 98. This range reflects a significant difference in problem-solving abilities, with some students performing exceptionally well, while others performed at lower levels.

Overall, this descriptive analysis showed that students had good critical and creative thinking skills, as well as excellent problem-solving abilities. Although there is variation in all three variables, these results suggest that the majority of students are at an adequate level in these important cognitive skills.

Based on this descriptive analysis, it can be concluded that the students of SD 22 Kampung Dalam Padang possed good critical and creative thinking skills. This means that students were quite capable of analyzing, evaluating, and connecting information in depth (critical thinking skills) and are also capable of generating new ideas and innovative solutions (creative thinking skills). Meanwhile, their problem-solving abilities are categorized as excellent, indicating that students are very adept at identifying problems, formulating alternative solutions, and selecting the most effective solution

Inferential Analysis:

From the results of the test analysis, the inferential data analysis can be obtained as follows:

Model Coefficients - Problem solving

Predictor	Estimate	SE	t	p
Intercept	20.24	9.164	2.21	0.037
Critical Thinking	3.37	0.997	3.38	0.003
Creative Thinking	1.96	1.083	1.81	0.083

Correlation Matrix

		Critical Thinking		Creative Thinking	Problem solving
Critical Thinking	Pearson's r	—			
	Df	—			
	p-value	—			
	95% CI Upper	—			
	95% CI Lower	—			
Creative Thinking	Pearson's r	0.703	***	—	

Model Coefficients - Problem solving						
Predictor	**Estimate**	**SE**	**t**	**p**		
	Df	25		—		
	p-value	< .001		—		
	95% CI Upper	0.855		—		
	95% CI Lower	0.441		—		
Problem solving	Pearson's r	0.781	***	0.703	***	—
	Df	25		25		—
	p-value	< .001		< .001		—
	95% CI Upper	0.895		0.855		—
	95% CI Lower	0.571		0.441		—

Note. * p < .05, ** p < .01, *** p < .001

The results of the correlation analysis show a strong and significant relationship between critical thinking, creative thinking, and students' problem-solving abilities. The correlation between critical thinking and creative thinking has a Pearson's r value of 0.703, indicating a fairly strong positive relationship between these two variables. This means that students who are more skilled in critical thinking tend to also have higher creative thinking abilities, and this relationship is statistically significant ($p < 0.001$), with a 95% confidence interval ranging from 0.441 to 0.855. Furthermore, the correlation between critical thinking and problem-solving ability is very strong, with a Pearson's r value of 0.781. This indicates that critical thinking ability is highly correlated with students' problem-solving skills. In other words, the higher the students' critical thinking ability, the better they are at solving problems. This relationship is also statistically significant ($p < 0.001$), with a 95% confidence interval between 0.571 and 0.895, indicating confidence in the strength of this relationship.

On the other hand, there is also a strong correlation between creative thinking and problem-solving skills, with a Pearson's r value of 0.703. This correlation indicates that more creative students tend to be better at solving problems. This relationship is also statistically significant ($p < 0.001$), with a 95% confidence interval ranging from 0.441 to 0.855, which reinforces the confidence that this relationship is consistent.

Overall, this analysis reveals that both critical and creative thinking skills have a positive and significant relationship with students' problem-solving abilities. The strongest relationship is between critical thinking and problem-solving skills, followed by the relationship between creative thinking and problem-solving skills, as well as the relationship between critical and creative thinking. This confirms the importance of developing critical and creative thinking skills to enhance students' ability to solve problems. The results of this study are consistent with previous research (Baker, 2001 and Uredi, 2020).

Thus, the analysis results show that the three abilities—critical thinking, creative thinking, and problem-solving—have significant and positive relationships with each other. The better someone is at critical thinking, the better their creative thinking and problem-solving skills. These findings can therefore serve as a reference for designing more effective teaching strategies to develop these abilities, creating effective learning experiences. In the learning process, teachers can provide challenges that encourage students to think creatively, such as asking them to find alternative solutions to everyday problems. Teachers can also offer various forms of assessment, considering the use of project-based or task assessments that combine critical thinking, creative thinking, and problem-solving. Students with strong critical and creative thinking skills will be more prepared to face the challenges of the 21st century.

▪ CONCLUSION

From the results of the descriptive analysis, it can be concluded that the students of SD Negeri 22 Kampung Dalam Padang have good critical and creative thinking skills, as well as excellent problem-solving abilities. There is a significant relationship between critical and creative thinking abilities and the students' problem-solving skills. The better a person's critical and creative thinking, the better their problem-solving abilities.

As educators, these results can serve as a reference for designing more effective teaching strategies to develop these skills in students. Teachers are expected to continuously enhance students' critical thinking, creative thinking, and problem-solving skills through learning. With higher levels of these abilities, students will be better equipped to face the challenges of the 21st century

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