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ANALYSIS OF STUDENTS' MATHEMATICAL PROBLEM-SOLVING ABILITY BASED ON SELF-CONFIDENCE

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ABSTRACT

Education plays an important role in developing students' potential, especially critical and creative thinking. Mathematics, as a core subject, supports students' problem-solving ability, which involves understanding, procedure selection, and application in new contexts. One factor that may influence this ability is self-confidence, as confident students are more persistent and independent in solving problems. This study aimed to examine the effect of self-confidence on students' mathematical problem-solving ability. The research employed a quantitative correlational design with a purposive sample of 60 seventh-grade students at SMP Negeri 8 Kota Gorontalo. Instruments consisted of a mathematical problem-solving test and a self-confidence questionnaire. Data were collected through tests and questionnaires, then analyzed using simple linear regression and correlation coefficient tests. The findings revealed that self-confidence significantly affects students' mathematical problem-solving ability. Students with higher self-confidence tended to achieve better outcomes. The correlation coefficient was 0.6923 (strong positive), with a coefficient of determination (R^2) of 47.22%, indicating that self-confidence contributed nearly half of the variation in problem-solving ability. The remaining 52.78% was influenced by other factors not examined in this study, such as math anxiety, learning habits, and environmental support. In conclusion, self-confidence has a positive and significant effect on mathematical problem-solving ability, suggesting the importance of fostering students' confidence alongside academic skills.

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INTRODUCTION

Education is a deliberate and systematic effort to create a learning environment that enables students to actively develop their potential in spiritual, emotional, critical thinking, cognitive, and social aspects (Harahap, 2023; Sukatin et al., 2021; Femilia et al., 2025). Education is not merely a process of transferring knowledge, but also a medium to shape character, cultivate creativity, and develop critical thinking skills that are essential in facing modern challenges

(Munawar, 2023). Within this framework, mathematics occupies a central role as one of the core subjects that supports logical, analytical, and systematic reasoning. Mastery of mathematics not only contributes to academic success but also equips students with problem-solving skills necessary for everyday life (Nurangaji et al., 2021; Santoso, 2023).

One of the main objectives of mathematics education is to enhance students' mathematical problem-solving skills, which include the ability to understand concepts, select appropriate procedures, and integrate both in new or unfamiliar situations (Marwiyah et al., 2020; Jufrin et al., 2023). In addition, mathematics is also a field of study that explores concepts enabling students to actively engage in mathematical problem-solving while serving as a supporting tool for other branches of knowledge (Mude et al., 2025). These skills are very important because they encourage students to think critically, analytically, and creatively (Asok, 2023; Rahmatiya & Miatun, 2020). Students with strong problem-solving abilities generally demonstrate greater independence, confidence, and creativity in the learning process (Fitriana et al., 2022). However, in practice, many students still perceive mathematics as difficult, particularly when faced with word problems or contextual tasks (Putri et al., 2023).

The analysis used in this study describes students' algebraic reasoning in relation to Logical-Mathematical Intelligence and Visual-Spatial Intelligence, which are then compared to the achievement of algebraic reasoning indicators accompanied by logical reasoning (Kobandaha et al., 2019). Through this approach, it is expected that a more comprehensive picture can be obtained of how students use their intelligences to understand algebraic concepts and develop logical reasoning skills.

Mathematical problem-solving involves several steps, including understanding the problem, planning a solution, carrying out the plan, and reviewing the obtained results (Sagita et al., 2023; Jannah & Wijayanti, 2021). The National Council of Teachers of Mathematics in (Mongilong et al., 2023) emphasizes that the goal of mathematics learning is to shape students to develop creative thinking, critical thinking, and problem-solving skills. These skills are not only important in academic contexts but also in everyday life, as students who are proficient in problem-solving tend to be more analytical and effective in decision-making (Namora, 2023). This is in line with Bandura's (2019) perspective, which states that self-confidence is an individual's belief in their ability to organize and carry out the steps necessary to achieve specific goals.

Self-confidence has been shown to significantly influence students' mathematical problem-solving abilities. Students with high self-confidence tend to be more persistent and capable of developing strategies when solving problems compared to those with low self-confidence (Susanti & Chairuddin, 2021; Putra et al., 2018). Conversely, a lack of self-confidence may lead to fear of making mistakes, reluctance to present answers, and dependence on others (Fitayanti et al., 2022). Previous studies have revealed a relationship between self-confidence and problem-solving ability (Nurhayatun, 2021; Hidayah, 2019), but most of them focused only on the extent of the influence, while few investigated how self-confidence affects the way students approach and solve mathematical problems.

Mathematics is often taught in the school curriculum (Kasim et al., 2024). According to the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 37 of 2018, algebraic operations and their solutions are considered Basic Competencies that must be achieved by seventh-grade students in the odd semester (Permendikbud RI No. 37, 2018). Algebraic operations are an important topic in mathematics learning because these concepts have many applications in solving everyday problems. Students need to understand this material as algebraic operations enable them to model and solve real-life situations. A strong understanding of this topic supports the development of effective mathematical problem-

solving skills. Therefore, learning algebraic operations is essential for students to gain deep comprehension and strong skills in solving mathematical problems. This material is crucial because it helps students model and solve real-world problems while supporting the development of mathematical problem-solving abilities (Putri et al., 2023; Hermawati et al., 2021). However, it has been found that many students are still not proficient in solving word problems due to a lack of problem variation and insufficient understanding of the solution steps (Fitayanti et al., 2022).

Preliminary observations at SMP Negeri 8 Kota Gorontalo revealed that most seventh-grade students still experience difficulties in solving algebra problems. Although the students were able to identify the problems, they were not yet proficient in planning strategies, applying procedures, and reviewing their answers. One of the factors influencing this condition is low self-confidence, which causes students to hesitate, fear making mistakes, and become less independent in problem-solving.

Based on these issues, this study aims to analyze students' mathematical problem-solving abilities in relation to their self-confidence. This research is expected to contribute to a better understanding of the relationship between affective factors and cognitive abilities, thereby enabling teachers to design effective learning strategies to enhance both students' problem-solving skills and their self-confidence in learning mathematics.

METHOD

This study employed a quantitative correlational approach to analyze the influence of self-confidence on students' mathematical problem-solving abilities. The research population consisted of seventh-grade students at SMP Negeri 8 Gorontalo, with a purposive sample of 60 students. The instruments used included a mathematical problem-solving test and a self-confidence questionnaire, both of which had been tested for validity and reliability. Data were collected through questionnaire administration and test implementation under teacher supervision. The data were analyzed after fulfilling the assumptions of normality, homogeneity, and linearity. Data analysis was carried out using simple linear regression and correlation coefficient tests.

Before conducting data analysis, it is necessary to classify students' self-confidence levels based on predetermined criteria. The classification criteria are as follows (Arikunto, 2018).

Interval	Category
$x \geq (\bar{x} + SD)$	High
$(\bar{x} - SD) < x < (\bar{x} + SD)$	Medium
$x \leq (\bar{x} - SD)$	Low

Where:

Calculating the mean ($\bar{x}$) : $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

Calculating the standard deviation (SD) : $SD = \sqrt{\frac{\sum f_i (x_i - \bar{x})^2}{n-1}}$

Simple linear regression was employed to examine the effect of variable X on variable Y. The regression model used is as follows:

$$\hat{Y} = a + bX \quad (1)$$

To calculate the values of a and b, the following formulas are used:

$$a = \frac{(\sum Y)(\sum X^2) - (\sum X)(\sum XY)}{N\sum X^2 - (\sum X)^2} \quad (2)$$

$$b = \frac{N\sum XY - (\sum X)(\sum Y)}{N\sum X^2 - (\sum X)^2} \quad (3)$$

(Kadir, 2015: 128)

Notes:

Y = Dependent Variable (Mathematical Problem-Solving Ability)

X = Independent Variable (Self-Confidence)

a = Regression constant, which represents the value of variable Y when variable X is equal to zero.

b = Regression coefficient, which describes the magnitude of change in the dependent variable (Y) resulting from a one-unit change in the independent variable (X). If the value of b is positive (+), the regression line slopes upward, whereas if the value of b is negative (–), the regression line slopes downward.

After obtaining the values of a and b, a simple linear regression equation was constructed to estimate how students' self-confidence in learning mathematics influences their mathematical problem-solving ability. The equation was then tested using the F-test.

$$F_{calculated} = \frac{RJK\ (b/a)}{RJK\ (S)} \quad (4)$$

(Kadir, 2015: 128)

Furthermore, a correlation coefficient test was conducted to examine whether there is a relationship between students' self-confidence and their mathematical problem-solving ability. The formula used was the product moment correlation.

$$r_{xy} = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{\{N\sum x^2 - (\sum x)^2\}\{N\sum y^2 - (\sum y)^2\}}} \quad (5)$$

(Sugiyono, 2021: 246)

Notes:

r_{xy} = Correlation coefficient between variable X and variable Y

N = Number of subjects

Σx = Total score of variable x

Σy = Total score of variable y

Σxy = Total product of variables x and y

Σx^2 = Sum of squared values of x

Σy^2 = Sum of squared values of y

The value of r is: $|r| \leq 1 \; or \; -1 \leq r \leq 1$, that is:

$r = 0$: There is no relationship or influence between variable x and variable y.

$r = 1$: There is a perfect positive relationship or influence between variable x and variable y

$r = -1$: There is a perfect negative relationship or influence between variable x and variable y

The level of closeness of the relationship between variable X and variable Y can be grouped based on the table of correlation coefficient values (r) as follows:

Table 1. Correlation Coefficient

Coefficient Interval	Degree of Relationship
0,00 – 0,199	Very Weak
0,20 – 0,399	Weak
0,40 – 0,599	Moderate
0,50 – 0,799	Strong
0,80 – 1, 000	Very Strong

RESULTS AND DISCUSSION

Results

Data from the Mathematical Problem-Solving Ability Test

The data from the mathematical problem-solving ability test refer to the scores obtained by students from the test on algebraic operations and are presented in the data recap shown in Table 2 below.

Table 2. Recapitulation of Mathematical Problem-Solving Ability Test Results

Variabel	Data						
	n	Skor maks	Skor min	Mean	Median	Modus	Standard Deviation
Problem-Solving Ability	**60**	**100**	**35**	**94,75**	**64,5**	**53,3**	**15,89**

Based on the results of documentation from 60 students as respondents, the highest score (maximum) on the mathematical problem-solving ability test was 100, while the lowest score (minimum) was 35. The mean was 94.75, the median was 64.5, the mode was 53.3, and the standard deviation was 15.89. From the maximum and minimum scores, the score range was calculated to be 65. Based on the number of samples (n), the number of classes was determined to be 7, and from the range and number of classes, the class width was calculated to be 9. The distribution of the obtained data was then organized into a frequency distribution table, as presented in Table 2.

Data from the Self-Confidence Questionnaire

The data from the self-confidence questionnaire represent the total scores obtained by students after completing the questionnaire, which are presented in the data recap shown in Table 3 below.

Table 3. Recapitulation of Self-Confidence Questionnaire Data

Variabel	Data						
	n	Skor maks	Skor min	Mean	Median	Modus	Standard Deviation
Self Confidence	60	100	40	97,7	66,92	70	18,66

Based on the distribution of questionnaires to 60 students as respondents, the highest student score obtained was 100 and the lowest was 40, with a mean of 67.7, a median of 66.92, and a mode of 70. This indicates that most students scored within the range of 64–71. The data distribution is relatively wide, as shown by the standard deviation of 18.66, indicating variations in students' abilities on the measured indicators. Using the predetermined categorization (high, moderate, and low), the results showed that 20% of students were classified as having high self-confidence, 55% were in the moderate category, and 25% were in the low category. This indicates that the majority of students had a moderate level of self-confidence, although there was still a considerable proportion of students who lacked confidence in learning mathematics.

The ideal score in the self-confidence questionnaire of this study was determined based on a total of 45 statements, using a 4-point Likert scale ranging from 1 to 4 for each item. Therefore, the minimum ideal score that students could obtain was 45 (if all statements were answered with the lowest score), while the maximum ideal score was 180 (if all statements were answered with the highest score). This range indicates that the higher the score obtained by students, the higher their level of self-confidence in learning mathematics, and vice versa. These scores served as a reference for categorizing students into high, moderate, or low self-confidence groups based on the results of data analysis.

Simple Linear Regression Test

Based on the results of the simple linear regression analysis, the test was conducted to determine the extent to which the independent variable (X) influences the dependent variable (Y). From the presented table, there were 60 pairs of X and Y data. The initial step in this analysis was to calculate key values such as the total of X, Y, squared X (X^2), squared Y (Y^2), and the product of X and Y (XY). These totals were then used to compute the regression coefficients, namely the intercept (a) and the slope (b). Based on the calculation, the simple linear regression equation obtained was: Y = 15,9974 + 0,7225X. This means that every one-unit increase in variable X will result in an increase of 0.7225 in variable Y, assuming other factors remain constant.

Furthermore, the significance of the regression model was tested using analysis of variance (ANOVA). From the ANOVA table, the calculated F value was 53.3724 with a significance value (Significance F) of $8{,}92 \times 10^{-10}$. Since the calculated F value was much greater than the critical F value, and the significance value was far below the significance level of 0.05, it indicates that the regression model is significant. Therefore, it can be concluded that variable X has a significant effect on variable Y.

In addition, the R Square value of 0.4722 indicates that approximately 47.22% of the variation in variable Y can be explained by variable X, while the remaining 52.78% is accounted for by

other factors outside this model. The Multiple R value of 0.6879 demonstrates a moderately strong correlation between X and Y. The regression output also shows that the slope coefficient (b) of 0.7225 has a p-value of $8{,}92 \times 10^{-10}$, which is far below the significance level of 0.05. This further confirms that the coefficient is statistically significant and contributes meaningfully to the regression model. Overall, the analysis indicates a positive and significant relationship between variable X and Y, and the simple linear regression model Y = 15,9974 + 0,7225X can be used to predict Y based on X. Nevertheless, since the R Square value is not close to 1, it is advisable to consider the inclusion of other independent variables that may influence Y in order to develop a more accurate predictive model. Despite this, the current model is sufficiently representative in explaining the linear relationship between the two variables in the available dataset.

Correlation Test

Based on the results of the correlation analysis using the Pearson test, as shown in the figure, the correlation coefficient (r) was 0.6923. This value indicates a strong relationship between variable X and variable Y. According to the table interpreting the degree of relationship, the value of 0.6923 falls within the interval of 0.60–0.799, which is classified as "strong." This means that changes in variable X (e.g., input factors, treatments, or initial scores) are consistently followed by changes in variable Y (output, learning outcomes, performance, etc.) in the same direction (positive).

Thus, the relationship is not perfect because there are still deviations or variations in the data, indicating that not every increase in variable X (self-confidence) is consistently followed by an increase in variable Y (mathematical problem-solving ability). This suggests that other factors may also influence the observed outcomes. This conclusion is further supported by the correlation level classification, which explicitly places the value of r = 0.6923 in the "Strong Correlation" category.

Discussions

This discussion aims to examine the relationship between mathematical problem-solving ability and self-confidence among seventh-grade students at SMP Negeri 8 Gorontalo in mathematics. This review is based on the research findings, which state that "self-confidence has a positive and significant relationship with the mathematical problem-solving ability of seventh-grade students at SMP Negeri 8 Gorontalo."

Description of Seventh-Grade Students' Mathematical Problem-Solving Ability at SMP Negeri 8 Gorontalo

Based on the test results of 60 students, the scores for mathematical problem-solving ability were as follows: the highest score was 100, the lowest score was 35, the mean was 94.75, the median was 64.5, and the mode was 53.3. The standard deviation of 15.89 indicates variation in problem-solving ability among students. Approximately 20% of the students scored around the mean, which may be due to fairly good conceptual understanding of mathematics that is not yet consistently applied, a stable but not optimal level of self-confidence, and balanced but limited learning experiences. About 50% of the students scored above the mean, which could be influenced by high self-confidence in approaching math problems, strong mastery of material and concepts, independent study habits, good metacognitive skills, and low levels of math anxiety, enabling them to work focused without excessive pressure. Meanwhile, 30% of the students scored below the mean, likely due to low self-confidence, high math anxiety, weak understanding of basic concepts, and limited practice and exposure to varied problem-solving tasks. These results indicate that a small portion of students achieved high scores, suggesting that good self-confidence can support more optimal problem-solving ability. This finding

reinforces the conclusion that self-confidence contributes significantly to students' success in solving mathematical problems.

The Relationship Between Mathematical Problem-Solving Ability and Self-Confidence

Based on the processed data from the self-confidence questionnaire administered to 60 seventh-grade students at SMP Negeri 8 Kota Gorontalo, it was found that students' self-confidence in learning mathematics ranged from moderate to high, with an average score of 97.7, a maximum score of 100, a minimum score of 40, and a standard deviation of 18.66. The distribution of scores indicates that most students have a positive tendency toward aspects of self-confidence, such as the ability to trust their own potential, act independently in making academic decisions, remain resilient when facing difficulties or failures in learning, and possess adequate social interaction skills within the school environment. However, a number of students were still categorized as having low self-confidence, characterized by shyness, fear of making mistakes, or lack of confidence in expressing opinions and facing challenges in mathematics. This condition suggests that students' self-confidence is not uniform, and adaptive and supportive teaching approaches are still needed to promote self-confidence, particularly among students in the low category. Such interventions aim to encourage students to participate more actively and confidently in mathematics learning, enabling them to solve problems independently and with assurance.

The results of this study indicate that self-confidence has a positive relationship with mathematical problem-solving ability. In other words, the higher the students' self-confidence, the better their ability to solve mathematical problems, and vice versa. This finding is in line with Bandura (2019), who explains that self-confidence is an individual's belief in organizing and executing the steps necessary to achieve a particular goal. Such belief significantly influences learning outcomes, including mathematical problem-solving ability. This result also aligns with Jannah and Wijayanti (2021), who state that problem-solving is a cognitive process involving identification, analysis, and resolution of problems by utilizing relevant knowledge and skills. The success of this process is not only determined by intellectual ability but also by the confidence students possess in applying appropriate solution strategies.

Similarly, a study by (Dede et al., 2022) revealed that students' self-confidence could be categorized into high, medium, and low. Students with high self-confidence were able to fulfill all four of Polya's problem-solving indicators, while those with medium self-confidence could only meet three indicators, and those with low self-confidence could not fulfill any of them. This strongly supports the findings of this study that differences in the level of self-confidence directly influence the quality of students' mathematical problem-solving abilities. Furthermore, research conducted by (Septyana et al., 2024) found that variations in self-confidence levels affected students' critical thinking skills. Students with high self-confidence were able to complete six indicators of mathematical critical thinking skills, while those with medium self-confidence achieved only five indicators, and those with low self-confidence managed to complete only one or two indicators. Although the study focused on critical thinking, its findings are relevant because critical thinking is an essential component of the mathematical problem-solving process.

Khoirunnisa and Malasari (2021) found that students with higher self-confidence demonstrated better mathematical critical thinking skills, while those with lower self-confidence showed weaker abilities. This supports the idea that self-confidence strongly influences students' success in mathematics.

This is also in line with the research findings, which show that the correlation coefficient of self-confidence (X) with mathematical problem-solving ability (Y), or r_{xy} is 0,6922 indicating a significant relationship between the two variables. Based on Table 3.5, which presents the

interpretation of r_{xy} values, the relationship between these variables is classified as strong. Furthermore, the contribution of X to Y is indicated by the coefficient of determination r_{xy}^2 = 0,479 meaning that 47.9% of the variation in mathematical problem-solving ability can be explained by self-confidence. The remaining 52.1% is influenced by other factors outside of self-confidence that were not examined in this study.

Based on the values obtained in this study, it can be concluded that self-confidence has a significant effect on students' mathematical problem-solving ability. Students with high levels of self-confidence tend to demonstrate better problem-solving outcomes. However, other factors accounting for 52.1% also influence mathematical problem-solving ability. This indicates that self-confidence is not the only factor affecting students' problem-solving skills. Various other factors play a role, both internal (such as physical, mental, and psychological conditions) and external (such as family environment, school context, teaching methods, and instructional strategies applied by teachers, among others).

CONCLUSION

In general, students' mathematical problem-solving ability is categorized as moderate. Among the 60 students, 24 students (40%) scored above the mean, while 36 students (60%) scored below the mean. The highest achievements were observed in problem comprehension and procedure application, whereas the design of solution strategies and evaluation of results remained low. This indicates that most students experience difficulties in developing appropriate solution steps and reflecting on their thinking processes. Students' self-confidence in learning mathematics was mostly in the moderate category. Some students demonstrated confidence in their abilities, independence, and resilience in facing challenges, but there were still students with low self-confidence, particularly in expressing opinions, presenting in front of the class, and solving problems independently. Low self-confidence can hinder students' willingness to take intellectual risks in mathematics learning. There is a significant positive relationship between self-confidence and mathematical problem-solving ability, with a correlation coefficient of 0.6923 (strong and positive). The coefficient of determination (R^2) indicates that self-confidence contributes 47.22% to the variation in problem-solving ability, while the remaining 52.78% is influenced by other factors not examined in this study, such as math anxiety, learning motivation, and support from the learning environment.

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