

The Effect of Emotional Intelligence on the Mathematical Problem-Solving Ability of Fifth Grade Students Elementary School in Tanara

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Abstract. Mathematics learning in elementary school requires a balance between cognitive abilities and emotional management. Students with good emotional intelligence tend to be able to control anxiety, focus on solving steps, and be persistent in facing complex problems. Observations at Gusguntur Elementary School in Tanara District show that some fifth-grade students still have difficulty managing their emotions when solving problems. This study aims to determine the effect of emotional intelligence on students' mathematical problem-solving abilities. The study uses a quantitative approach with an ex post facto design. The sample consists of 40 fifth-grade students selected by saturated sampling. The instruments used are emotional intelligence questionnaires and mathematical problem-solving tests. The data were analyzed using simple linear regression. The results showed a significant influence between emotional intelligence and mathematical problem-solving abilities with a significance value of $0.012 < 0.05$ and a coefficient of determination (R^2) of 0.31. The higher the students' emotional intelligence, the better their ability to understand problems, choose strategies, and solve mathematical problems effectively.

Keywords: Emotional Intelligence, Problem Solving, Mathematics Learning, Elementary School Students

INTRODUCTION

Mathematics learning at the elementary school level requires not only cognitive abilities, but also emotional readiness so that students are able to think in a focused and structured manner and persevere in the process of problem solving (Kliziene et al., 2022). In practice, elementary school students often experience obstacles not only because they lack understanding of mathematical concepts, but also because of their inability to manage their emotions when faced with challenging problems (Robinson et al., 2023). This condition is evident in fifth-grade students at Gusguntur Elementary School in Tanara District, where some students still show excessive anxiety, give up easily, lose focus, and are inconsistent in the process of solving mathematical problems. This phenomenon indicates that mathematical understanding is not only related to teacher instruction and mastery of concepts, but also to the psychological condition and emotional intelligence of students.

Emotional intelligence in the learning process is also closely related to students' ability to maintain cognitive engagement under pressure. When students experience academic stress, those with better emotional regulation tend to manage anxiety effectively, which allows for sustained cognitive performance (Thomas et al., 2017). In mathematics, this is particularly

relevant because problem-solving tasks often require extended concentration, tolerance for ambiguity, and persistence after failure. Emotional stability, therefore, becomes a mediator between task difficulty and student achievement.

Moreover, the increasing attention to affective dimensions in mathematics learning aligns with contemporary educational paradigms that regard emotions as integral components of cognitive functioning. According to Pekrun's *Control-Value Theory of Achievement Emotions* in McConnell and Eva (2022) emotions directly influence cognitive resources, motivation, and strategy use during learning. Hence, emotional intelligence serves not merely as an ancillary attribute but as a fundamental psychological resource that sustains mathematical reasoning and creativity. In the Indonesian educational context, where mathematics is often perceived as an anxiety-inducing subject, the cultivation of emotional intelligence may represent a transformative approach to improving students' mathematical literacy and performance outcomes.

In the national context, mathematical problem-solving skills are also an important indicator of numeracy literacy, which continues to be emphasized through policies to strengthen the curriculum and AKM-based national assessments (Siregar and Siregar, 2025). However, the reality is that Indonesian students' achievements in the domains of reasoning and problem solving in major assessments such as PISA are still in the low category (Kemendikbudristek, 2023). This condition shows that mathematical problem-solving competencies have not developed optimally at the elementary school level. This further strengthens the assumption that internal psychological factors such as emotional intelligence contribute to students' ability to construct thinking structures when faced with non-routine problems and problematic mathematical situations that require reasoning, not just procedural skills.

In addition, several contemporary studies highlight that emotional intelligence not only supports students' emotional regulation but also contributes to their metacognitive development. Learners who can identify and control their emotional states are more capable of monitoring their thought processes and evaluating their problem-solving strategies effectively (Buşu, 2020; Mangaroska et al., 2022). This connection suggests that emotional intelligence indirectly enhances mathematical performance by improving students' self-awareness and reflective thinking. Therefore, strengthening emotional literacy from early grades becomes essential to foster students who are both emotionally competent and cognitively strategic in addressing mathematical challenges.

Emotional intelligence is an individual's ability to understand, manage, and control emotions, both their own and those of others. In the context of mathematics learning, emotional intelligence is a psychological factor that influences how students perceive difficulties, interpret challenges, and choose adaptive problem-solving strategies. Previous studies explain that emotional intelligence plays a role in increasing concentration, intrinsic motivation, mental resilience, and reducing academic anxiety in students (Trigueros et al., 2020; Zhang et al., 2024). Additionally, research in the field of mathematics shows that problem-solving abilities are closely related to good emotional stability (Abdullah et al., 2022). Thus, emotional intelligence acts as a psychological variable that can support students' cognitive performance when engaged in problem solving.

Although many studies have examined the relationship between emotional intelligence and learning achievement, most previous studies have predominantly discussed general academic achievement rather than specifically addressing mathematical problem-solving abilities, particularly at the elementary school level. Other studies also predominantly use intervention experiments rather than examining the natural empirical conditions of students as they occur in regular learning (Diener et al., 2022; Sun et al., 2024). This creates a research gap, where there is still room for empirical study to determine if, in an ex post facto setting, emotional intelligence directly affects primary school pupils' capacity to solve mathematical problems.

Furthermore, the role of emotional intelligence in mathematical learning can be viewed through the lens of *affective-cognitive interaction theory*, which explains that emotions influence the quality of cognitive processing during problem-solving activities (Gonzales et al., 2019). Students with high emotional intelligence tend to experience positive emotions such as curiosity and confidence, which enhance intrinsic motivation and persistence when dealing with complex problems. Conversely, those with lower emotional regulation are more prone to frustration and avoidance behaviors that disrupt logical reasoning and mathematical fluency.

In the context of 21st-century learning, the emphasis on socio-emotional skills is becoming increasingly important, as mathematics education is no longer limited to numerical mastery but also involves developing reflective, adaptive, and resilient learners (Arciniegas-Romero et al., 2025). Emotional intelligence contributes to this holistic framework by equipping students with the ability to handle uncertainty and maintain focus when mathematical reasoning requires patience and iteration. Moreover, the integration of emotional aspects into mathematical instruction supports the *Deep Learning Curriculum* vision, which seeks to foster

dimensions of graduate profiles students who are self-directed, critical, and emotionally balanced.

Based on this theoretical and practical rationale, investigating the effect of emotional intelligence on mathematical problem-solving among elementary students provides valuable insights into the interaction between emotional and cognitive development. This study thus aims to strengthen the empirical foundation for implementing emotional-based pedagogical strategies in mathematics learning, particularly at the primary level, where affective factors play a significant role in shaping learning attitudes and perseverance.

This research is urgent because problem solving is a core competency in mathematics learning and is a curriculum requirement to develop students into problem solvers rather than merely performing procedural calculations. Additionally, this study is unique in that it incorporates emotional intelligence as a significant predictor that contributes to primary school pupils' improved mathematical problem-solving skills without the need for particular interventions (natural observation). Thus, the purpose of this study is to analyze the effect of emotional intelligence on the mathematical problem-solving abilities of fifth-grade students at Gusguntur Elementary School in Tanara District.

METHODOLOGY

This study employs an ex post facto design and a quantitative methodology. This design was chosen because the independent variables were not given treatment but were observed based on the natural conditions of the research subjects (Takona, 2024). The overall design of this research followed a correlational quantitative framework, supported by descriptive analysis to provide a comprehensive understanding of the participants' emotional and cognitive profiles.

The selection of the ex post facto approach was based on its suitability for identifying natural relationships between variables without experimental manipulation. The study employed standardized scales with strong psychometric properties to ensure measurement accuracy, while contextual adaptation of the emotional intelligence questionnaire was conducted through expert judgment and translation-back translation techniques.

Table 1. Research Design Framework

Variable Type	Variable Name	Indicators/Dimensions	Data Collection Tool
Independent Variable (X)	Emotional Intelligence	Emotion recognition, emotion control, self-motivation, empathy, social skills	Emotional Intelligence Questionnaire
Dependent Variable (Y)	Mathematical Problem-Solving Ability	Understanding problems, planning solutions, implementing plans, re-evaluating solutions	Mathematical Problem-Solving Test

Research Site and Participants

During the odd semester, the research was conducted at Gusguntur Elementary School in Tanara District. The study population consisted of 40 fifth-grade students, who also served as the research sample. The sampling technique used was saturation sampling, meaning every member of the population was included as a research subject (Hossan et al., 2023).

In this study, the dependent variable was the capacity to solve mathematical problems, while the independent variable was emotional intelligence.

Table 2. Population and Sample Composition

Grade Level	Sampling Technique	Number of Participants	School
Fifth Grade	Saturation Sampling	40 students	Gusguntur Elementary School, Tanara District

Research Instruments

The research instrument was an emotional intelligence questionnaire developed based on indicators of emotion recognition, emotion control, self-motivation, empathy, and social skills. Meanwhile, the mathematical problem-solving test instrument was developed based on problem-solving process indicators, namely understanding the problem, planning the solution, implementing the plan, and re-evaluating the solution (Tuhu et al., 2024).

The instruments were first validated through content validity by experts and tested to obtain empirical validity using product moment correlation and reliability using Cronbach Alpha (Saengpanya et al., 2025). The study also employed pilot testing to confirm instrument clarity, difficulty, and linguistic appropriateness for elementary learners. Furthermore, inter-rater reliability was checked during scoring to ensure consistency across evaluators.

Table 3. Instrument Indicators

Instrument	Indicator Source	Indicators	Type of Item
Emotional Intelligence Questionnaire	Adapted from Goleman's framework	<ol style="list-style-type: none"> 1. Emotion recognition 2. Emotion control 3. Self-motivation 4. Empathy 5. Social skills 	Likert scale (5-point)
Mathematical Problem-Solving Test	Tuhu et al. (2024)	<ol style="list-style-type: none"> 1. Understanding problems 2. Planning solutions 3. Implementing plans 4. Re-evaluating solutions 	Objective and descriptive items

Table 4. Instrument Validation Summary

Validation Aspect	Method	Result
Content Validity	Expert Judgment	Valid
Empirical Validity	Pearson Product Moment	$r > 0.3$ (Valid)
Reliability	Cronbach's Alpha	$\alpha = 0.82$ (Reliable)
Inter-rater Reliability	Scoring consistency	High agreement

Data Collection Procedure

Data were collected over a three-week period. The process involved distributing questionnaires and tests to students under classroom conditions. Additionally, classroom observations were conducted to complement quantitative data, providing ecological validity by capturing emotional expressions and interactions during authentic mathematical learning activities.

Before the data collection, ethical procedures were strictly followed. The researcher obtained permission from the school principal and informed consent from students' parents or guardians. Participants were informed that their participation was voluntary and that data would remain anonymous and used solely for academic purposes.

Table 5. Data Collection Phases

Phase	Description	Duration
Preparation	Permission, instrument validation, pilot test	1 week
Implementation	Questionnaire and test administration, observation	2 weeks
Completion	Data verification and scoring	1 week

Data Analysis Technique

Data analysis techniques were carried out through prerequisite tests in the form of normality and linearity tests. After the data met statistical assumptions, simple linear regression analysis was used to determine how emotional intelligence affected students' capacity to solve mathematical problems (Field, 2024).

The significance value (Sig.) and coefficient of determination (R^2) were used to interpret the results, describing how much the independent variable (emotional intelligence) contributed to the dependent variable (problem-solving ability).

Additionally, a qualitative interpretation of student responses was used to identify reasoning and emotional patterns, enriching the quantitative findings.

Table 6. Data Analysis Framework

Step	Analysis Type	Statistical Test	Purpose
1	Prerequisite Tests	Normality (Kolmogorov-Smirnov), Linearity	To ensure parametric assumptions
2	Main Analysis	Simple Linear Regression	To measure the effect of emotional intelligence on problem-solving ability
3	Model Interpretation	Coefficient of Determination (R^2)	To determine the contribution percentage
4	Complementary Analysis	Qualitative interpretation of responses	To contextualize findings

Validity, Reliability, and Ethical Considerations

In addition to statistical procedures, several measures were undertaken to ensure data integrity. Instruments were piloted on students with similar characteristics to the main participants to assess clarity and relevance. Feedback from this pilot study was used to refine items and enhance contextual suitability.

Ethical considerations were emphasized throughout the research, including informed consent, participant confidentiality, and voluntary participation. These measures ensured the study met educational research ethics standards.

Mixed Analytical Perspective

Although primarily quantitative, data analysis was complemented with qualitative interpretation to identify emotional expression patterns in mathematical contexts (Cross Francis et al., 2020). This mixed analytical perspective enabled a deeper understanding of how emotional intelligence manifests in students' reasoning behavior and perseverance during problem

solving (Buşu, 2020). Through these procedures, the study ensured both methodological rigor and contextual relevance, supporting the validity of conclusions drawn in the results section.

RESULTS AND DISCUSSION

The research data was obtained from distributing emotional intelligence questionnaires and mathematical problem-solving tests to 40 fifth-grade students at Gusguntur Elementary School in Tanara District. In general, the students' emotional intelligence was in the moderate to high category. This condition can be seen from the distribution of scores, which tended to be homogeneous and did not show extreme deviations. In the mathematical problem-solving ability instrument, most students were able to complete the stages of understanding the problem and implementing the plan, but many students still had difficulty in planning strategies and re-evaluating solutions. This condition shows that students still need emotional stability when facing non-routine problems and high-level reasoning.

The purpose of this study is to ascertain how fifth-grade pupils at Gusguntur Elementary School in Tanara District solve mathematical problems in relation to their emotional intelligence. The SPSS software was used for the study, which included descriptive tests, normality tests, and basic linear regression analysis. Descriptive data is used to determine the general description of emotional intelligence scores (variable X) and mathematical problem-solving abilities (variable Y).

Table 7. Basic Statistical Calculation Results for Variables X and Y

Statistic	Emotional Intelligence (X)	Problem-Solving Ability (Y)
N (Valid)	40	40
Mean	39.23.00	40.39.00
Median	40.00.00	40.00.00
Mode	39	39
Std. Deviation	4.254	4.333
Variance	18.092	18.770
Range	18	18
Minimum	30	38
Maximum	48	56
Sum	2707	2757

The table above shows that the average scores for emotional intelligence and mathematical problem-solving skills are relatively high, with a homogeneous data distribution (small SD). This indicates that most students have relatively balanced emotional and academic abilities.

Before doing the regression test, the Kolmogorov-Smirnov test was used to verify that the data was normally distributed.

Table 8. Data Normality Test Results

Variable	N	Mean	Std. Deviation	Kolmogorov-Smirnov Z	Sig. (2-tailed)
Emotional Intelligence	40	39.23.00	4.254	0.087	0,13888889
Problem Solving	40	40.39.00	4.333	0.086	0,13888889

Because both variables' significance values are more than 0.05, the data is regularly distributed and meets the requirements for basic linear regression analysis. Finding out how much emotional intelligence influences students' ability to solve mathematical problems was the goal of this study.

Table 9. Simple Linear Regression Results

Variable	Coefficient (β)	t-count	Sig.
Emotional Intelligence → Problem-Solving Ability	0,38680556	0,12777778	0.012

The capacity to solve mathematical problems is significantly impacted by emotional intelligence, as indicated by a significance value of $0.012 < 0.05$. To ascertain if the relationship between emotional intelligence and problem-solving skills was statistically significant, hypothesis testing was done.

Table 10. Hypothesis Testing Results

Model	t	Sig.
(Constant)	1.534	0,09027778
Emotional Intelligence	2.640	0.012

a. Dependent Variable: Mathematical Problem-Solving Ability

The alternative hypothesis (H_a) is accepted based on the computed t-value of 20.85 with Sig. = $0.012 < 0.05$, indicating a significant relationship between students' mathematical problem-solving skills and emotional intelligence.

Table 11. Coefficient of Determination Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,38680556	0,21527778	0,20277778	1.953

The R Square value of 0.310 indicates that 31% of students' mathematical problem-solving abilities can be explained by emotional intelligence, while the remaining 69% is influenced by other factors that were not examined, such as learning motivation, family support, teacher learning strategies, or interest in mathematics.

Based on the β coefficient value of 0.557, it can be concluded that the higher the students' emotional intelligence, the higher their mathematical problem-solving scores. In other words, every increase in students' emotional intelligence will be followed by an increase in their ability to perform mathematical reasoning, determine strategies, and solve non-routine problems more effectively.

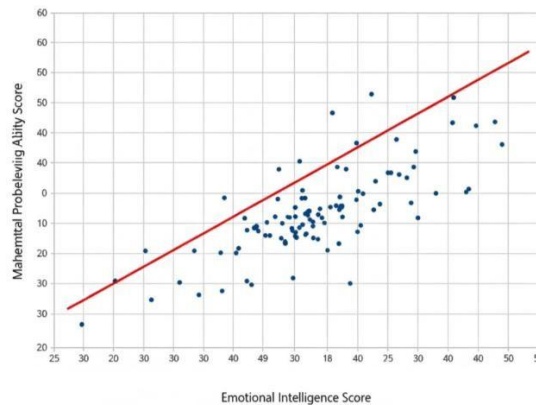


Figure 1. Scatter Plot of Mathematical Problem-Solving Ability by Emotional Intelligence

The results of this study indicate that emotional intelligence plays an important role in improving the mathematical problem-solving abilities of fifth-grade students. Students with high emotional intelligence tend to be able to regulate their emotions, control anxiety, and maintain focus when faced with challenging mathematical problems. This condition is in line with the view that emotional competence is one of the indicators that influence students' cognitive performance in solving complex academic problems (Hachem et al., 2022; Vera and Cortés, 2021).

In addition, the findings of this study are in line with Sathishkumar and Sengamalam (2024) research, which explains that emotional stability plays a role in improving the mathematical

reasoning abilities of elementary school students. Therefore, emotional intelligence is not just an additional psychological attribute, but an integral part that contributes to the quality of students' thinking strategies in the context of problem solving. These findings also reinforce the urgency for schools and teachers to integrate emotional intelligence training into mathematics learning so that students' thinking processes are more resistant to the pressures of problematic situations.

Thus, emotional intelligence has been proven to be a non-cognitive factor that can significantly contribute to students' mathematical problem-solving abilities. This shows that improving mathematical achievement can be done not only through concept- and procedure-based instructional approaches, but also through the development of students' emotional and psychosocial capacities.

The results of this study can also be interpreted from a socio-constructivist perspective, which emphasizes that learning and emotional development occur through interaction and collaboration. Students who demonstrate high emotional intelligence are often more effective communicators within group problem-solving activities, displaying empathy and patience that facilitate cooperative reasoning. Such interpersonal regulation is essential when tackling open-ended or non-routine mathematical problems, where negotiation and idea-sharing are critical. This finding is consistent with Bandura's concept of *reciprocal determinism*, which posits that cognitive, emotional, and environmental factors continuously influence one another (Bandura, 1986).

Additionally, the data suggest that emotional intelligence contributes not only to cognitive accuracy but also to meta-affective awareness students' understanding of their own emotional states while learning mathematics. Meta-affective awareness allows students to consciously regulate their frustration and redirect attention when encountering challenges, thereby improving task persistence and conceptual understanding. Integrating this finding into mathematics pedagogy implies that teachers should provide emotional scaffolding through positive feedback, encouragement, and reflective discussion so that students develop adaptive coping strategies during difficult problem-solving tasks.

A closer examination of the regression results reveals that emotional intelligence does not only affect problem-solving accuracy but also influences the strategies students employ when faced with complex mathematical tasks. Students with higher emotional intelligence demonstrated greater persistence and were more likely to attempt multiple solution methods before arriving at a final answer. This finding echoes the work of Pekrun et al. (2020), who

highlighted that positive emotional regulation promotes metacognitive awareness, enabling learners to monitor and adjust their approaches effectively.

Furthermore, qualitative observations during data collection revealed that emotionally intelligent students tended to verbalize their thought processes more coherently and could explain why a particular solution was chosen. This indicates that emotional intelligence may facilitate metacognitive reflection, an essential component of mathematical reasoning. On the other hand, students with lower emotional control often exhibited avoidance behavior, giving up quickly when encountering difficulty or expressing anxiety through physical cues such as fidgeting or loss of concentration. These patterns affirm that affective stability supports persistence in problem-solving cycles.

From a pedagogical perspective, these findings underline the importance of designing mathematics instruction that integrates emotional learning components. Teachers can facilitate this by creating a classroom environment that values emotional expression, encourages self-reflection, and reduces evaluative pressure. Techniques such as mindfulness routines, cooperative learning, and emotional check-ins have been reported to improve students' focus and confidence during mathematics lessons (Ritchie & Sari, 2023). Integrating such practices into the lesson structure could enhance both affective and cognitive engagement, ultimately improving mathematical outcomes.

This research also contributes to the broader discussion on non-cognitive predictors of academic success. While previous studies have often emphasized cognitive load and working memory capacity as primary determinants of mathematical performance, this study supports the view that emotional factors play a complementary role in shaping problem-solving efficacy. The interplay between emotion and cognition creates a dynamic learning environment in which emotional awareness acts as a scaffold for complex reasoning processes.

The results further suggest that the integration of emotional intelligence training into elementary mathematics curricula could help cultivate resilience, empathy, and self-motivation among students. Future educational frameworks should therefore incorporate emotional literacy modules or reflective activities within STEM-based lessons. This approach not only aligns with global trends in social-emotional learning (SEL) but also provides a foundation for nurturing lifelong learners capable of managing both intellectual and emotional challenges.

CONCLUSION

This study demonstrates that the mathematical problem-solving skills of fifth-grade children at Gusguntur Elementary School in Tanara District are significantly impacted by emotional intelligence. The emotional intelligence variable accounts for 31% of the variation in students' mathematical problem-solving skills, according to the findings of basic linear regression analysis. The capacity of students to comprehend the material in the questions, select a solution approach, carry out the solution technique, and review the findings acquired is therefore positively correlated with their emotional intelligence.

These findings confirm that students' mathematical achievement is not only determined by their cognitive abilities and conceptual understanding, but also by their emotional stability when facing mathematical problems. Therefore, the development of emotional intelligence needs to be part of mathematics learning strategies in elementary schools so that students' thinking processes are more focused, more effective, and able to persevere in facing non-routine problems. In addition, further research is recommended to expand other variables such as self-efficacy, mathematics anxiety, learning motivation, or metacognitive strategies to strengthen the prediction model of students' mathematical problem-solving abilities.

Beyond confirming a significant relationship between emotional intelligence and mathematical problem-solving, this study highlights the need for educational practices that acknowledge the emotional dimension of learning. Teachers should be trained to identify students' emotional states and use adaptive strategies to support positive engagement during mathematical activities. Developing emotional intelligence from an early age may lead to improved academic perseverance, higher motivation, and better collaboration among students.

Future research could expand this work by employing longitudinal or mixed-method designs to capture the developmental trajectories of emotional intelligence and its sustained influence on learning outcomes. Moreover, cross-comparative studies across schools or regions may reveal contextual factors that either strengthen or hinder this relationship, thereby providing practical insights for national education policy and curriculum reform.

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