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The Relationship Between Mathematics Anxiety and Problem-Solving Skills among Junior High School Students in Indonesia

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Abstract

Mathematics anxiety is a well-documented affective factor that negatively impacts students' performance and engagement in mathematics. This study examines the relationship between mathematics anxiety and problem-solving skills among junior high school students in Indonesia. A total of 35 students from Grades 7 and 8 at SMP Sangkara in Medan participated. Mathematics anxiety was measured using a 20-item Likert scale (lower scores indicate higher anxiety), while problem-solving ability was assessed through a five-question open-ended test scored on a 4-point rubric. Descriptive statistics indicated moderate to high mathematics anxiety ($M = 33.31$, $SD = 6.59$) and low to moderate problem-solving ability ($M = 8.06$, $SD = 4.33$). Pearson correlation showed a statistically significant association ($r = 0.774$, $p < .001$). Because the anxiety scale was reverse-coded, the result indicates that higher mathematics anxiety was associated with lower problem-solving performance. These findings provide preliminary evidence that addressing affective challenges may help improve students' mathematical problem-solving skills in similar contexts.

Kecemasan matematika merupakan faktor afektif yang telah banyak dikaji dan diketahui berdampak negatif terhadap kinerja serta keterlibatan siswa dalam pembelajaran matematika. Penelitian ini bertujuan untuk menyelidiki hubungan antara kecemasan matematika dan keterampilan pemecahan masalah pada siswa sekolah menengah pertama di Indonesia. Sebanyak 35 siswa kelas VII dan VIII dari SMP Sangkara Medan berpartisipasi dalam penelitian ini. Kecemasan matematika diukur menggunakan kuesioner skala Likert 20 butir (skor rendah menunjukkan tingkat kecemasan yang tinggi), sedangkan keterampilan pemecahan masalah dinilai melalui lima soal uraian yang diberi skor dengan rubrik empat tingkat. Hasil statistik deskriptif menunjukkan tingkat kecemasan matematika sedang hingga tinggi ($M = 33,31$; $SD = 6,59$) dan kemampuan pemecahan masalah rendah hingga sedang ($M = 8,06$; $SD = 4,33$). Analisis korelasi Pearson menunjukkan hubungan yang signifikan secara statistik ($r = 0,774$; $p < 0,001$). Karena skala kecemasan diberi kode terbalik, hasil ini menunjukkan bahwa semakin tinggi kecemasan matematika, semakin rendah kemampuan pemecahan masalah siswa. Temuan ini memberikan bukti awal bahwa penanganan tantangan afektif dapat membantu meningkatkan keterampilan pemecahan masalah matematika siswa dalam konteks yang serupa.

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Introduction

Mathematics plays a crucial role in developing students' logical reasoning and problem-solving abilities. However, despite its importance, it is often perceived as intimidating, leading to feelings of anxiety among learners. Ashcraft and Faust (1994) describe mathematics anxiety as a condition

involving tension, nervousness, or fear that interferes with numerical processing and problem-solving in both educational and real-life situations. More recent studies further confirm that mathematics anxiety not only affects cognitive processing but also influences students' motivation and engagement in learning mathematics (Barroso et al., 2021; Foley et al., 2017).

In the Indonesian educational context, students frequently demonstrate low achievement in mathematical problem-solving tasks, as reflected in national examinations and international assessments such as Programme for International Student Assessment (PISA). Organisation for Economic Co-operation and Development (OECD) (2019) reported that Indonesian students continue to perform below the international average in mathematics literacy. Although educational programs often emphasize cognitive development, affective factors such as mathematics anxiety remain insufficiently explored in local studies. Recent evidence suggests that mathematics anxiety continues to be a prevalent issue among Indonesian students and may significantly influence learning outcomes (Juniardi et al., 2024; Miatun & Ulfah, 2023). Affective domains, including anxiety, have a substantial impact on students' learning outcomes but are rarely addressed in classroom practice.

Over the past six decades, researchers have consistently explored the nature and consequences of mathematics anxiety. Dowker et al. (2016) emphasized that mathematics anxiety is a multidimensional construct influenced by cognitive, affective, and environmental factors. They noted that anxiety can emerge as early as elementary school and persist through adulthood, often leading to avoidance behaviours toward mathematics-related tasks. This long-term pattern of avoidance contributes to a self-reinforcing cycle where low confidence and reduced engagement further diminish mathematical performance. The authors also highlighted those effective interventions must address both emotional regulation and instructional design to break this cycle. Supporting this perspective, Kaskens et al. (2020) demonstrated that factors such as self-efficacy and teacher competence play a significant role in shaping students' mathematical development and anxiety levels.

Earlier, Hembree (1990) provided a meta-analytic review demonstrating that mathematics anxiety negatively correlates with students' achievement and persistence in mathematics. His findings showed that students with higher levels of anxiety tend to perform poorly on tests and are less likely to pursue mathematics-related subjects. Similarly, Minsoo (2012) found a significant negative relationship between mathematics anxiety and achievement among secondary school students in Malaysia, reinforcing the idea that affective factors play a crucial role in shaping mathematical outcomes. More recent meta-analytic and empirical studies have further strengthened this relationship, confirming that mathematics anxiety is consistently associated with lower mathematical performance across various educational contexts (Barroso et al., 2021; Pérez-Fuentes et al., 2020). These studies collectively underline the global significance of mathematics anxiety as a barrier to learning and emphasize the importance of examining its impact within diverse educational contexts, including Indonesia.

Problem-solving is a central aspect of the mathematics curriculum and is vital for success both in academic and real-world contexts. However, elevated levels of anxiety may hinder students' capacity to engage effectively in problem-solving, particularly when faced with complex or unfamiliar problems. Polya (1957) proposed a four-stage model of problem-solving, understanding the problem, devising a plan, carrying out the plan, and reviewing the result, which requires sustained cognitive focus that may be disrupted by anxiety. Recent studies also highlight that psychological factors, such as self-efficacy and emotional regulation, significantly influence students' ability to solve mathematical problems (Jameson et al., 2024; Ramirez et al., 2018).

Despite growing global evidence, limited studies in Indonesia have specifically examined the relationship between mathematics anxiety and problem-solving skills, particularly at the junior high school level. Furthermore, recent findings indicate that mathematics anxiety may not always be influenced by gender differences, suggesting that it is a more universal and context-dependent phenomenon (Marpaung et al., 2025). This highlights the need for more localized research that focuses on the interplay between affective and cognitive factors in mathematics learning.

Considering the significant influence of mathematics anxiety on academic achievement, this study investigates the relationship between mathematics anxiety and students' problem-solving skills among junior high school students in Medan, Indonesia. The findings are expected to provide empirical evidence to guide instructional strategies aimed at reducing anxiety while enhancing mathematical competence. This research contributes localized evidence from Medan, Indonesia, where mathematics anxiety remains an underexplored topic.

Methods

This study employed a quantitative correlational design to examine the relationship between mathematics anxiety and students' problem-solving ability, aiming to determine the strength and direction of the association between the two variables without manipulating any conditions. The participants consisted of 35 junior high school students from SMP Sangkara, Medan, Indonesia, including Grade 7 students (n = 18) and Grade 8 students (n = 17), selected using a total sampling technique. Data collection was conducted during the 2024/2025 academic year, specifically between July 2024 and June 2025. Mathematics anxiety was measured using a 20-item Likert-type questionnaire adapted from established instruments, with responses rated on a 4-point scale ranging from 1 (strongly agree) to 4 (strongly disagree), and reverse scoring applied such that lower total scores indicated higher levels of anxiety. Content validity was established through expert judgment by three mathematics educators, while internal consistency reliability was confirmed using Cronbach's Alpha ($\alpha = 0.82$), indicating good reliability. Students' problem-solving ability was assessed using five open-ended mathematics problems derived from the junior high school curriculum, evaluated using a four-point rubric focusing on reasoning clarity, strategy selection, and accuracy, with a maximum score of 20.

Content validity of the test was verified through expert review, and inter-rater reliability was assessed by two independent evaluators, yielding a Cronbach's Alpha coefficient of 0.76, indicating acceptable reliability. Data were collected during regular classroom sessions, where students were informed about the purpose of the study and assured that their participation was voluntary. Ethical considerations were addressed by ensuring informed consent, confidentiality of responses, and obtaining permission from school authorities prior to data collection.

Data Analysis

The data collected from the two instruments were analysed quantitatively. Descriptive statistics, including mean and standard deviation, were computed to summarize students' levels of mathematics anxiety and problem-solving ability. To examine the relationship between the two variables, the Pearson Product-Moment Correlation Coefficient (r) was employed. This test was selected because both mathematics anxiety scores and problem-solving scores are continuous variables and were assumed to follow a normal distribution. The strength and direction of the correlation were interpreted using conventional thresholds. Statistical significance was determined through a two-tailed test with an alpha level of 0.05. All statistical analyses were performed using IBM SPSS Statistics software.

Students were made aware that participation in the study was optional and that their responses would be kept confidential. Descriptive statistics included the calculation of the mean (M) and standard deviation (SD) to summarize the central tendency and dispersion of students' scores in mathematics anxiety and problem-solving ability.

The mean was calculated using the following formula:

$$\bar{X} = \frac{X_i}{n}$$

In this formula, $\bar{X}$ is the mean, X_i signifies individual student scores, and n denotes the number of students involved.

The standard deviation was calculated using:

$$SD = \sqrt{\frac{X_i - \bar{X}}{n-1}}$$

to assess the extent of variation within the data.

To examine the relationship between mathematics anxiety and problem-solving ability, the Pearson Product-Moment Correlation Coefficient (r) was employed. This statistical test was chosen because both variables are continuous and assumed to be normally distributed. The formula for Pearson's r is as follows:

$$r = \frac{n\sum XY - (\sum X)\,(\sum Y)}{\sqrt{[n\ \sum X^2 - (\sum X)^2]\ [n\ \sum Y^2 - (\sum Y)^2]}}$$

where:

- X = scores of mathematics anxiety
- Y = scores of problem-solving ability
- n = number of respondents

The correlation coefficient r ranges from -1 to 1, where values closer to -1 or 1 indicate stronger linear relationships, and values near 0 indicate weak or no linear correlation.

To assess whether the observed correlation between the variables was statistically significant, the study employed a two-tailed hypothesis test with a significance threshold alpha ($\alpha = 0.05$). This approach allowed for evaluating the probability that the observed relationship could have occurred by chance in either direction. Relationships with a p-value less than 0.05 were considered statistically significant.

All computations and statistical tests were executed using IBM SPSS Statistics.

Result and Discussion

Result

Descriptive Statistics

The average mathematics anxiety score (M = 33.31, SD = 6.59) reflects a moderate to high level of anxiety, due to the reversed scoring scale. The average problem-solving score (M = 8.06, SD = 4.33) indicates low to moderate performance.

Table 1. Descriptive Statistics of Variables

Variable	N	Min	Max	Mean	SD
Mathematics Anxiety	35	26	55	33. 31	6. 59
Problem-Solving Skill	35	2	18	8. 06	4. 33

Correlation Analysis

The Pearson correlation between math anxiety and problem-solving was r = 0.774, p < 0.001. Although the correlation coefficient is positive, the reverse-coded nature of the anxiety scale means that the relationship is conceptually negative. Therefore, the findings indicate that higher levels of mathematics anxiety are significantly associated with lower problem-solving performance.

Table 2. Correlation Between Mathematics Anxiety and Problem-Solving Ability

Variable	R	P
Anxiety ↔ Problem Solving	0. 774	< 0.001

Reliability Analysis

The internal consistency of the instruments was evaluated using Cronbach's Alpha. As presented in Table 3, the Mathematics Anxiety Scale showed good reliability ($\alpha = 0.82$), while the Problem-Solving Test demonstrated acceptable reliability ($\alpha = 0.76$). These findings confirm that both instruments were sufficiently reliable for use in this study.

Table 3. Reliability Analysis of Research Instruments

Instrument	Number of Items	Cronbach's Alpha	Reliability Level
Mathematics Anxiety Scale	20	0.82	Good
Problem Solving Test	5	0.76	Acceptable

Scatter Plot Analysis

A scatter plot was created to further illustrate the relationship between mathematics anxiety and problem-solving ability (Figure 1). The plot demonstrated a clear linear trend, with higher levels of mathematics anxiety associated with lower problem-solving scores. The regression line confirmed this negative association. The coefficient of determination ($R^2 = 0.5455$) indicated that mathematics anxiety accounted for approximately 54.55% of the variance in problem-solving performance, while the remaining 45.45% was explained by other factors not examined in this study. Within the context of educational research, this explanatory power is considered moderate to strong.

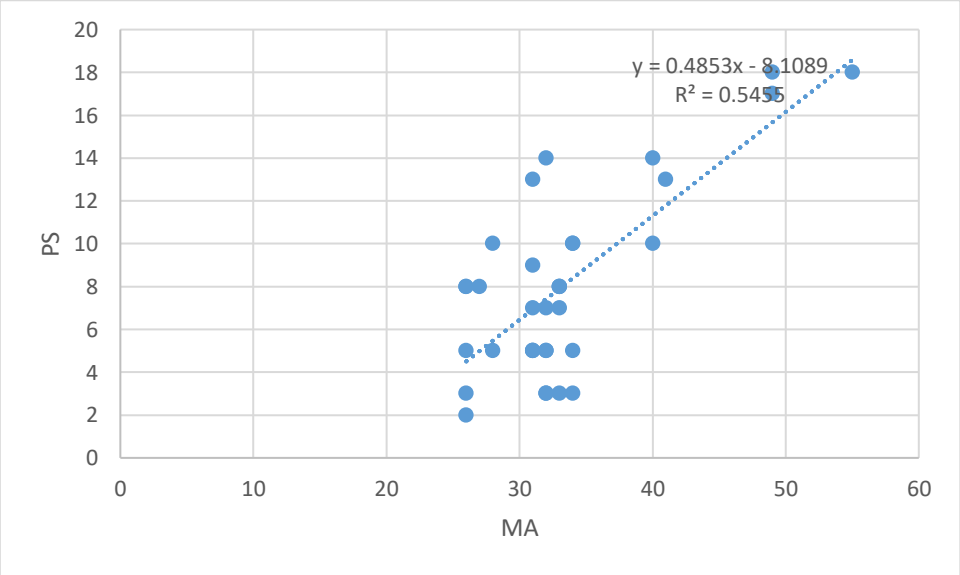

Figure 1. Scatter Plot of Mathematics Anxiety and Problem-Solving Ability

The scatter plot shows the linear relationship between mathematics anxiety and problem-solving ability among junior high school students. The regression line indicates a negative association, with higher levels of mathematics anxiety corresponding to lower problem-solving performance. The R^2

value of 0.5455 suggests that mathematics anxiety explains about 54.55% of the variance in problem-solving ability.

Line Graph Analysis

In addition to the scatter plot, a line graph was plotted to illustrate the trend between mathematics anxiety and problem-solving ability. As shown in Figure 2, when mathematics anxiety scores increased (indicating lower levels of anxiety due to the reverse coding), problem-solving performance also tended to rise. This pattern reinforces the negative relationship between mathematics anxiety and problem-solving ability: students who reported less anxiety were more capable of solving mathematical problems effectively.

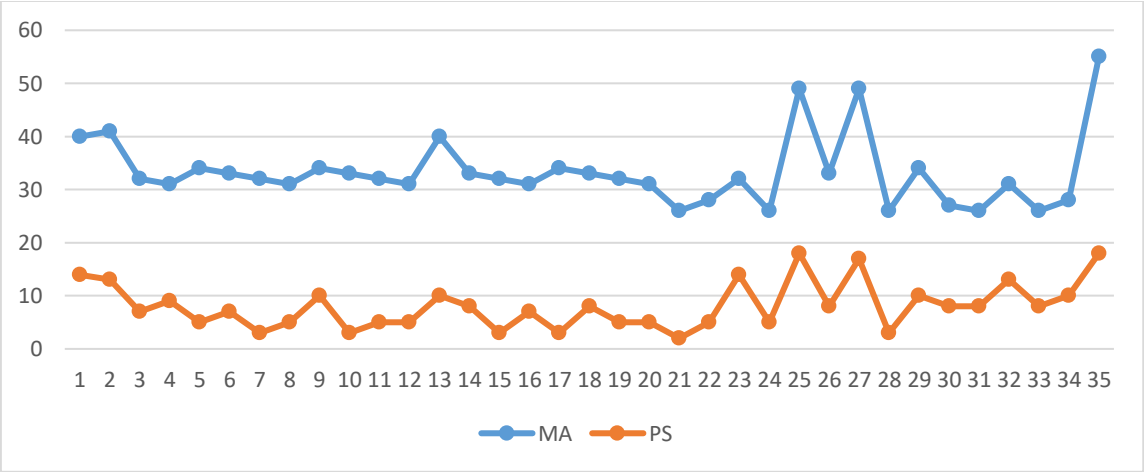

Figure 2. Line Graph of Mathematics Anxiety and Problem-Solving Ability

The line graph demonstrates that higher mathematics anxiety scores (reflecting lower anxiety) are associated with higher problem-solving performance, supporting the negative relationship between the two variables.

Discussion

The results of this study demonstrate a strong and statistically significant relationship between mathematics anxiety and problem-solving ability. Although the statistical correlation was positive ($r = 0.774$), this result must be interpreted considering the reversed scoring system, where lower scores indicate higher anxiety. Thus, the findings reveal a negative relationship between the two variables: as mathematics anxiety increases, students' ability to solve mathematical problems tends to decrease.

These findings align with prior research, such as Ashcraft & Krause (2007), which emphasized that high levels of math anxiety can impair working memory and cognitive function. Students with elevated anxiety levels may struggle to focus, second-guess their problem-solving strategies, or disengage from mathematical tasks prematurely, all of which hinder successful performance.

In the context of this study, various classroom factors may contribute to students' anxiety, including pressure from high-stakes testing, rigid instructional methods, or negative past experiences

with math. Consequently, fostering a supportive emotional environment in math instruction becomes a critical factor. Teachers are encouraged to adopt supportive instructional approaches, such as:

- Formative assessments to reduce evaluation pressure,
- Real-life problem contexts to improve relevance,
- Group collaboration to build peer support, and
- Encouragement of growth mindset and resilience.

However, the current study has limitations. The small sample size (n = 35) and the single school setting limit the generalizability of results. Future studies should include more diverse samples across multiple regions and explore additional moderating variables, such as gender, prior achievement, and instructional style.

Implications for Practice

These results provide meaningful insights for improving mathematics education practices in the Indonesian context. Given the strong association between mathematics anxiety and problem-solving ability, teachers should adopt strategies that reduce anxiety while enhancing engagement in mathematical tasks. For example, incorporating interactive approaches such as mathematics games and real-life problem contexts can create a more relaxed classroom atmosphere and gradually build students' confidence. Furthermore, teachers may collaborate with school counsellors to provide psychological support for students who experience high levels of anxiety, ensuring that both academic and emotional needs are addressed. Developing classroom routines that encourage open communication and normalize mistakes as part of the learning process can also help reduce fear and anxiety.

Limitations

Despite its contributions, this study has several limitations. The relatively small sample size (n = 35) drawn from a single school in Medan restricts the generalizability of the findings to other contexts in Indonesia. In addition, while content validity was established through expert judgment, more comprehensive validity analyses (e.g., construct validity) were not conducted. Future research should expand the sample to include multiple schools across diverse regions and perform more rigorous validity testing. Finally, other potentially relevant factors such as gender, prior mathematics achievement, and instructional style were not considered in this study and warrant exploration in future research.

Conclusion

This study confirmed a significant relationship between mathematics anxiety and problem-solving ability among Indonesian junior high school students. The findings demonstrate that higher

levels of mathematics anxiety are associated with lower problem-solving performance, highlighting the importance of addressing affective factors in mathematics education.

By recognizing the role of emotional barriers, educators can design classroom practices that not only develop students' cognitive skills but also support their emotional well-being. These results provide preliminary evidence that may inform instructional strategies in similar junior high school contexts and underscore the need for interventions aimed at reducing mathematics anxiety.

Recommendation

Building upon these limitations, future studies should involve larger and more diverse samples across multiple regions to improve the generalizability of the results. Researchers are also encouraged to incorporate additional validity measures, such as construct validity, and to use mixed-method approaches that capture both quantitative outcomes and qualitative insights into students' experiences of mathematics anxiety.

Moreover, examining the role of moderating variables, such as gender, teaching approaches, or classroom climate, could provide a deeper understanding of how mathematics anxiety interacts with other factors. Finally, intervention-based studies that implement and evaluate strategies to reduce mathematics anxiety, such as classroom-based relaxation techniques or teacher professional development, would provide valuable guidance for both policymakers and practitioners.

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