Social Anxiety, Math Anxiety, and Problem-Solving in Fifth-Grade Students: A Correlational Study

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Abstract. *The ability to solve mathematical problems is an essential component of elementary mathematics learning, yet students' performance may be associated with affective factors, including social anxiety and math anxiety. This study aimed to examine the relationships between social anxiety, math anxiety, and mathematical problem-solving ability among fifth-grade students in Gugus 1, Lowokwaru District, Malang City, Indonesia. The study employed a quantitative approach with a correlational design involving 178 fifth-grade students. Data were collected using questionnaires measuring social anxiety and math anxiety, along with a mathematical problem-solving test consisting of essay questions. The data were analyzed using descriptive statistics, assumption testing, and multiple linear regression. The results showed that the regression model was statistically significant, $F(2, 175) = 5.858$, $p = .003$, with an R^2 of .063. Math anxiety was significantly negatively associated with mathematical problem-solving ability ($\beta = -.284$, $p = .001$), whereas social anxiety was not significantly associated with mathematical problem-solving ability ($\beta = .105$, $p = .209$). These findings indicate that, in the present sample, mathematical problem-solving ability was more strongly associated with math anxiety than with social anxiety.*

Keyword: *mathematical problem-solving; math anxiety; social anxiety; elementary school students; mathematics learning*

Abstrak. *Kemampuan pemecahan masalah matematika merupakan salah satu komponen penting dalam pembelajaran matematika di sekolah dasar. Kemampuan tersebut dapat berkaitan dengan berbagai faktor afektif, termasuk kecemasan sosial dan kecemasan matematika. Penelitian ini bertujuan untuk menganalisis hubungan antara kecemasan sosial, kecemasan matematika, dan kemampuan pemecahan masalah matematika pada siswa kelas V di Gugus 1, Kecamatan Lowokwaru, Kota Malang, Indonesia. Penelitian ini menggunakan pendekatan kuantitatif dengan desain korelasional yang melibatkan 178 siswa kelas V. Data dikumpulkan melalui kuesioner untuk mengukur kecemasan sosial dan kecemasan matematika serta tes pemecahan masalah matematika berbentuk soal uraian. Data dianalisis menggunakan statistik deskriptif, uji asumsi, dan regresi linear berganda. Hasil analisis menunjukkan bahwa model regresi signifikan secara statistik, $F(2, 175) = 5{,}858$, $p = 0{,}003$, dengan nilai R^2 sebesar 0,063. Kecemasan matematika memiliki hubungan negatif yang signifikan dengan kemampuan pemecahan masalah matematika ($\beta = -0{,}284$, $p = 0{,}001$), sedangkan kecemasan sosial tidak menunjukkan hubungan yang signifikan ($\beta = 0{,}105$, $p = 0{,}209$). Hasil tersebut menunjukkan bahwa dalam sampel penelitian ini, kemampuan pemecahan masalah matematika lebih kuat berkaitan dengan kecemasan matematika dibandingkan dengan kecemasan sosial. Temuan ini menunjukkan pentingnya mempertimbangkan faktor afektif yang berkaitan secara khusus dengan matematika dalam mengkaji kemampuan pemecahan masalah matematika siswa sekolah dasar.*

Kata Kunci: *kemampuan pemecahan masalah matematika; kecemasan matematika; kecemasan sosial; siswa sekolah dasar; pembelajaran matematika.*

INTRODUCTION

Mathematical problem-solving ability is a fundamental aspect of mathematics learning, as it involves students' capacity to comprehend problems, formulate strategies, carry out solutions, and assess the results (Pólya, 1957; Wildaniati et al., 2024). It involves more than producing an accurate answer, as students must apply mathematical knowledge, reasoning, strategies, and representations to solve contextual problems (Kaitera & Harmoinen, 2022). At the elementary school level, this ability is especially important as students are expected to apply mathematical knowledge and reasoning to increasingly complex problems (Kurniawati et al., 2022). Therefore, identifying factors associated with mathematical problem-solving ability is important for supporting effective mathematics learning.

Although mathematical problem solving involves substantial cognitive processes, students' performance may also be associated with affective factors (Živković et al., 2023). Emotional conditions during mathematics learning may influence students' concentration, engagement, confidence, and persistence when facing challenging tasks (Doz et al., 2024). Among these affective factors, math anxiety has received considerable attention because it specifically arises in mathematics-related situations. Math anxiety is characterized by tension, worry, and fear that may hinder performance when working with numbers and solving mathematical problems (Gashaj et al., 2023; Richardson & Suinn, 1972; Zanabazar et al., 2023). Such anxiety may be particularly relevant when students solve non-routine problems requiring sustained attention and appropriate strategy selection.

Previous research has generally reported a negative relationship between math anxiety and mathematical performance, although the magnitude of this relationship differs across age groups and task characteristics. A meta-analysis encompassing .747 effect sizes identified a small-to-moderate negative relationship between math anxiety and mathematics achievement. ($r = -.28$), with a smaller association among students in Grades 3–5 (Barroso et al., 2021). Similarly, a meta-analysis of 57 studies reported a significant negative association with mathematics performance ($r = -.168$) and suggested that working memory may partly account for this relationship (Finell et al., 2022). Evidence from elementary school students further indicates that higher math anxiety may be associated with less advanced problem-solving strategies and lower processing efficiency during demanding mathematical tasks (Ramirez et al., 2016; Shi et al., 2022). Taken together, these findings indicate that math anxiety may be relevant to mathematical problem-solving through differences in strategy use and cognitive processing.

Beyond mathematics-specific anxiety, students may also experience anxiety in social situations. Social anxiety refers to fear, apprehension, or discomfort when individuals anticipate being observed, evaluated, or judged by others (Alomari et al., 2022; Rasouli et al., 2022). In school settings, social anxiety may affect students' experiences because classroom

activities often involve interaction with teachers and peers and situations in which their performance is observed or evaluated. Research involving children with social phobia has shown that greater social anxiety is associated with attention difficulties and learning problems in the classroom (Bernstein et al., 2008). Evidence from primary school students has also indicated an association between social anxiety and academic performance (Prieto et al., 2023). However, whether social anxiety is associated with mathematical problem-solving ability, particularly in individual written tasks, remains unclear.

Although social anxiety and math anxiety represent different forms of anxiety, both may be relevant to students' experiences during mathematics learning. Cheng et al. (2022) examined mathematics anxiety alongside broader social-emotional attitudes in relation to students' mathematics learning, supporting the relevance of affective factors beyond mathematics-specific anxiety. Previous studies have primarily examined math anxiety in relation to mathematics achievement or problem-solving performance, whereas research on social anxiety has more commonly focused on social functioning, interpersonal experiences, or psychological outcomes (Alomari et al., 2022; Rasouli et al., 2022). This distinction underscores the importance of investigating whether social anxiety and math anxiety are associated with mathematical problem-solving ability, particularly among elementary school students.

The association between anxiety and mathematical problem-solving ability may be interpreted theoretically through Attentional Control Theory (ACT). ACT suggests that anxiety may impair the efficiency of goal-directed attentional control while increasing the influence of stimulus-driven attention, particularly when inhibition and shifting are involved (Eysenck et al., 2007). Because mathematical problem solving requires sustained attention, strategy selection, and monitoring across multiple steps, reduced attentional control may make such tasks more demanding. Thus, ACT provides a framework for interpreting the associations of social anxiety and math anxiety with mathematical problem-solving ability. However, because attentional control was not directly measured, ACT is used as a theoretical framework rather than a tested mediating mechanism.

Based on these theoretical and empirical considerations, this study hypothesized that social anxiety (H1) and math anxiety (H2) are significantly associated with mathematical problem-solving ability, while both predictors are simultaneously associated with it (H3) among fifth-grade students in Gugus 1, Lowokwaru District, Malang City.

METHODS

A quantitative correlational design was employed to investigate the associations among social anxiety, math anxiety, and mathematical problem-solving ability among fifth-grade students in Gugus 1, Lowokwaru District, Malang City, Indonesia. The population

comprised 178 fifth-grade students from four elementary schools, and total sampling was used because the entire accessible population was included as participants. Data were collected from August to September and administered directly by the researcher in each class, with approximately 60 minutes allocated per class.

Social anxiety was measured using a 23-item questionnaire adapted from the Social Interaction Anxiety Scale (Mattick & Clarke, 1998). The items were translated into Indonesian and adapted for fifth-grade students by simplifying sentence structures, replacing unfamiliar expressions with age-appropriate language, and contextualizing statements around interactions with teachers and peers. An independent expert reviewed the adapted items for clarity, relevance, and developmental appropriateness while preserving their intended meaning. During administration, the researcher explained the instructions and allowed students to ask questions about items they did not understand. No formal assessment of students' comprehension was conducted.

Math anxiety was assessed using a 15-item questionnaire adapted from the Modified Abbreviated Math Anxiety Scale (Carey et al., 2017). Although the original m-AMAS contains nine items, the instrument was adapted for fifth-grade students by adjusting item wording and contexts and expanding coverage to two dimensions: anxiety during mathematics learning and mathematics evaluation. Items were rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Positively worded items were reverse-scored so that higher total scores indicated greater math anxiety.

Mathematical problem-solving ability was assessed using four non-routine contextual essay problems covering fractions, greatest common factor and least common multiple (GCF/LCM), perimeter and area, and data representation. Based on Pólya (1957) problem-solving framework, each response was scored using a holistic rubric ranging from 0 to 5 per problem, yielding a total score of 0–20. The rubric assessed problem understanding, strategy selection, strategy execution, solution accuracy, and mathematical argumentation. The scoring criteria are presented in Table 1. All responses were scored by one researcher using predetermined criteria; inter-rater reliability was not calculated, which represents a limitation of the study.

Table 1. Holistic Scoring Rubric for Mathematical Problem-Solving Ability

Score	Performance criteria
0	No relevant response or evidence of a problem-solving process.
1	Very limited understanding of the problem, with no meaningful strategy or mathematical reasoning.
2	Partial understanding and an attempted strategy, but with substantial errors or an inappropriate approach.
3	Adequate understanding and a partially appropriate strategy, but with notable errors or omissions in execution, solution, or explanation.
4	Clear understanding, an appropriate strategy, and a largely correct solution, with minor errors or incomplete verification or explanation.
5	Complete understanding, an appropriate and accurately executed strategy, a correct solution, and logical mathematical explanation or verification.

Note. The rubric considers five aspects: problem understanding, strategy selection, strategy execution, solution accuracy, and mathematical

argumentation, aligned with Pólya's problem-solving framework.

Instrument quality was evaluated through expert judgment, corrected item–total correlations, and Cronbach's alpha using data from the 178 participants in the main study. No separate pilot sample was used for item analysis. Items with corrected item–total correlations of at least 0.30 were retained. For social anxiety, 14 of the initial 23 items met this criterion ((r = 0.302)–(0.591)). Cronbach's alpha was calculated after item selection using the retained items, yielding (\alpha = 0.798) for the final 14-item scale. Reliability coefficients for all instruments are reported in Table 2.

Table 2. Summary of Instrument Evaluation Results

Instrument	Initial Items	Valid Items	CITC Range	Cronbach's α	Final Items
Social Anxiety	23	14	0.302–0.591	0.798	14
Math Anxiety	15	15	0.354–0.592	0.855	15
Mathematical Problem-Solving Ability	4	4	0.439–0.573	0.716	4

Before regression analysis, the dataset was checked for missing values, and none were identified. Regression assumptions were assessed using the Shapiro–Wilk test of standardized residuals for normality, deviation-from-linearity tests, residual plots and the Breusch–Pagan test for homoscedasticity, the Durbin–Watson statistic, tolerance and variance inflation factors (VIF) for multicollinearity, and Cook's distance for influential observations. Hierarchical multiple regression was conducted to examine the unique and incremental contributions of the predictors, with social anxiety entered in Model 1 and math anxiety added in Model 2. The change in explained variance (ΔR^2) and the F-change test were used to assess the additional contribution of math anxiety. Statistical significance was evaluated using t-tests, F-tests, and the F-change test, with R^2 indicating explained variance. Because participants were drawn from four elementary schools, potential within-school clustering was acknowledged; multilevel regression was not conducted because the limited number of schools was insufficient for reliable estimation of school-level effects.

Research Ethics

Permission to conduct the study was obtained through the relevant university, school, and local education authority procedures. Student information was kept confidential, and the collected data were used solely for research purposes.

RESULT AND DISCUSSION

Result

Descriptive Statistics

Descriptive statistics for the three study variables are presented in Table 3 for 178 fifth-grade students.

Table 3. Descriptive Statistics, Reliability, and Score Classification

Variable	Observed range	Theoretical range	M	SD	α	Classification	Skewness	Kurtosis
Social anxiety	14–67	14–70	34.20	9.340	.798	Moderate	.266	.196
Math anxiety	15–63	15–75	39.18	9.830	.855	Moderate	−.225	−.111
Mathematical problem-solving ability	1–20	0–20	9.74	3.864	.716	Moderate	.315	−.051

Note. N = 178. α = Cronbach's alpha. Classifications were based on dividing each theoretical score range into three equal-width categories (low, moderate, and high). Social anxiety: low = 14–32.67, moderate = 32.68–51.33, high = 51.34–70. Math anxiety: low = 15–35, moderate = 35.01–55, high = 55.01–75. Mathematical problem-solving ability: low = 0–6.67, moderate = 6.68–13.33, high = 13.34–20.

The descriptive statistics, reliability coefficients, and score classifications for the three study variables are presented in Table 3. All variables fell within the moderate category based on their theoretical score ranges. The skewness and kurtosis values indicated relatively small deviations from symmetry and normality in the score distributions.

Assumption Testing

The regression assumptions were examined before analysis. The Shapiro–Wilk test indicated no significant departure from normality (W = 0.989, p = .181). Deviation-from-linearity tests were non-significant for social anxiety, F(37, 139) = 0.806, p = .775, and math anxiety, F(42, 134) = 0.745, p = .864, although the linear component for math anxiety was significant, F(1, 134) = 10.091, p = .002. The Breusch–Pagan test indicated no significant evidence of heteroscedasticity, F(2, 175) = 1.892, p = .154. The Durbin–Watson statistic was 1.415; however, it does not establish independence among students within the same school. Multicollinearity was not indicated (tolerance = 0.766; VIF = 1.306), and Cook's distance values were below 0.048, suggesting no unduly influential observations. Because participants were drawn from four schools and multilevel regression was not conducted, potential within-school clustering remains a limitation, and the regression results should be interpreted cautiously.

Pearson correlations showed that social anxiety was positively associated with math anxiety but was not significantly associated with mathematical problem-solving ability, whereas math anxiety showed a significant negative association with mathematical problem-solving ability (Table 4).

Table 4. Pearson Correlations among Study Variables

Variable	1	2	3
1. Social Anxiety	—	.484***	−.032
2. Math Anxiety	.484***	—	−.233**
3. Mathematical Problem-Solving Ability	−.032	−.233**	—

**Note. ***p < .001; p < .01.

Hierarchical Multiple Regression Analysis

The hierarchical regression analysis showed that Model 1, which included social anxiety, explained 0.1% of the variance in mathematical problem-solving ability but was not statistically significant. Adding math anxiety in Model 2 significantly increased the explained variance by 6.2% ($\Delta R^2 = .062$, p = .001). The final model was statistically significant and explained 6.3% of the variance in mathematical problem-solving ability.

Table 5. Hierarchical Multiple Regression Results

Predictor	Model 1 B	SE	β	p	Model 2 B	SE	β	p
Constant	10.187	1.105	—	<.001	12.616	1.290	—	<.001
Social Anxiety	−0.013	0.031	−.032	.673	0.044	0.035	.105	.209
Math Anxiety	—	—	—	—	−0.112	0.033	−.284	.001

Table 6. Model Summary

Model	R	R^2	Adjusted R^2	ΔR^2	Overall F (df)	p (overall)	ΔF (df)	p (F-change)
1	.032	.001	−.005	—	0.179 (1, 176)	.673	—	—
2	.251	.063	.052	.062	5.858 (2, 175)	.003	11.526 (1, 175)	.001

Note. Model 1 includes social anxiety. Model 2 adds math anxiety. R = multiple correlation coefficient; R^2 = coefficient of determination; Adjusted R^2 = adjusted coefficient of determination; ΔR^2 = change in R^2; F = overall model F-statistic; ΔF = F-change statistic; df = degrees of freedom. The overall p value indicates the significance of each regression model, whereas the F-change p value indicates whether adding math anxiety significantly improves the model beyond social anxiety.

Discussion

The findings indicate that math anxiety and social anxiety showed different patterns of association with mathematical problem-solving ability among fifth-grade students. Math anxiety was negatively associated with problem-solving ability, whereas social anxiety did not show a significant unique association when both predictors were considered together. However, the regression model explained only a small proportion of the variance, suggesting that these anxiety-related factors provide a limited explanation of students' problem-solving performance.

The negative association between math anxiety and mathematical problem-solving ability is consistent with previous research reporting an inverse relationship between math anxiety and mathematics performance or problem-solving. Doz et al. (2023) linked math anxiety to primary school students' arithmetic word-problem performance through perceived task difficulty, while Guo and Liao (2022) reported associations between math anxiety and problem-solving performance. Ratna and Yahya (2022) also reported a relationship between math anxiety and mathematical problem-solving ability, accounting for 15.4% of the variance in their study. The smaller proportion of variance explained in the present study may reflect differences in participants' ages, mathematical tasks, measurement instruments, and research contexts.

The negative association between math anxiety and mathematical problem-solving ability may be interpreted through Attentional Control Theory (ACT), which suggests that anxiety can reduce the efficiency of goal-directed attention during demanding cognitive tasks (Eysenck et al., 2007). Mathematical problem solving requires students to sustain attention, select appropriate strategies, execute procedures, and evaluate solutions. Math anxiety may therefore interfere with the effective allocation of cognitive resources during problem solving. However, the relationship may also be reciprocal: repeated difficulties or poor performance in mathematics may increase students' worry and negative expectations, potentially reinforcing math anxiety over time. Because this study used a cross-sectional correlational design, the direction of this relationship cannot be established.

The finding is also relevant to research on the development of math anxiety among students. Math anxiety has been documented among elementary school students (Szczygieł

& Pieronkiewicz, 2022), while negative mathematics experiences may be associated with greater math anxiety (Hunt & Maloney, 2022). Fear of failure and performance concerns have also been identified as relevant factors (Pizzie & Kraemer, 2023). These factors, however, were not directly examined in the present study.

In contrast, social anxiety did not show a significant unique association with mathematical problem-solving ability. This finding should be interpreted cautiously rather than as evidence that social anxiety is unrelated to problem-solving. One possible explanation is that the adapted Social Interaction Anxiety Scale (SIAS), originally developed for adults, may not fully capture forms of social anxiety relevant to elementary school students. In addition, the small observed association may have limited the ability to detect a relationship.

Other contextual and measurement factors may also help explain the finding. The overlap between social anxiety and math anxiety may have reduced the unique contribution of social anxiety in the regression model, while the individual written-test format may have provided fewer social-evaluative situations than classroom activities involving public responses, peer interaction, or presentations. These explanations remain tentative because the relevant mechanisms were not directly examined in this study.

The stronger association observed for math anxiety may also reflect the conceptual proximity of this construct to the outcome. Cheng et al. (2022) emphasized that math anxiety represents a distinct psychological construct rather than simply a form of broader social-emotional anxiety. Whereas math anxiety is specifically related to mathematics-related situations, social anxiety concerns interpersonal interaction and evaluation. Thus, math anxiety may be more directly relevant to a mathematics problem-solving task.

Although the regression model was statistically significant, social anxiety and math anxiety jointly explained only 6.3% of the variance in mathematical problem-solving ability. Other factors may therefore contribute to students' performance. Research involving primary school students indicates that mathematical problem solving is associated with cognitive and metacognitive processes, including understanding problems, selecting and executing appropriate strategies, and evaluating solutions (García et al., 2016; Kusaka & Ndihokubwayo, 2022). Anxiety should therefore be viewed as one affective factor associated with mathematical problem solving rather than a comprehensive explanation of students' performance.

Several limitations should be considered. The cross-sectional correlational design does not support causal conclusions, while self-report questionnaires may be affected by students' interpretation of items and response tendencies. In addition, participants came from one school cluster in Lowokwaru District, Malang City, which limits generalizability. Potential dependence among students from the same school also could not be fully addressed, so the regression findings should be interpreted cautiously. In practice, teachers may consider low-stakes assessments,

supportive classroom environments, and strategies to help students manage mathematics-related anxiety. Future research should involve more diverse school settings and examine additional cognitive, affective, and contextual factors associated with mathematical problem-solving ability.

CONCLUSION

This study examined the associations of social anxiety and math anxiety with mathematical problem-solving ability among fifth-grade elementary school students. Math anxiety was significantly and negatively associated with problem-solving ability, whereas social anxiety did not show a significant unique association after controlling for math anxiety. Although the overall regression model was statistically significant, the two predictors explained only 6.3% of the variance in problem-solving ability, indicating that their explanatory contribution was limited. These findings suggest that math anxiety may be a relevant affective factor to consider in elementary mathematics learning, while students' problem-solving ability should be understood as a multifaceted outcome influenced by factors beyond anxiety.

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