Analysis of the Profile and the Relationship Between Mathematics Anxiety, Critical Thinking, and Financial Literacy Among Junior High School Students in Palu City

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Abstract

Mathematics anxiety, critical thinking, and financial literacy can affect students' concentration and learning outcomes. To overcome students' anxiety about mathematics, the low critical thinking skills and financial literacy of junior high school students in Palu City, starting with data that describes the profile and relationship of the third variable. Therefore, this research was carried out with the aim of describing the profile and relationship between mathematics anxiety, critical thinking and financial literacy of junior high school students in Palu City. This research is a survey study using both quantitative approaches. The sampling method employed is proportional stratified random sampling. The research sample consists of 415 eighth-grade junior high school students in Palu City. The instruments used include a math anxiety questionnaire, a critical thinking test, and a financial literacy test. The validity utilized includes content validity based on expert judgment and construct validity using Confirmatory Factor Analysis (CFA), while reliability is measured using Cronbach's alpha coefficient. All instruments were found to be valid and reliable. The data analysis technique used was interval estimation with a confidence level of 95% and path analysis with $\square$ = 0,05. The results of the study indicate that: (1) The math anxiety of junior high school students in Palu City is at a moderate level; (2) The critical thinking skills of junior high school students in Palu City are at a very low level; (3) The financial literacy of junior high school students in Palu City is categorized as low; (4) a) There is a negative relationship and a direct effect of math anxiety on critical thinking; b) There is a positive relationship and a direct effect of critical thinking on financial literacy; c) There is a negative relationship and a direct effect of math anxiety on financial literacy, as well as an indirect relationship between math anxiety and financial literacy through critical thinking.

*Keywords: Mathematics Anxiety; Critical Thinking; Financial Literacy*

Introduction

Students with mathematics anxiety tend to avoid situations that require mathematical thinking, which in turn reduces their opportunities to practice and improve critical thinking skills. Students experiencing mathematics anxiety often face difficulties in critical thinking due to emotional barriers that hinder their ability to think logically and systematically (Ennis, 2018). Critical thinking skills are essential in financial literacy, particularly for making effective financial decisions (OECD, 2019). Students with

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stronger critical thinking abilities tend to demonstrate higher levels of financial literacy, highlighting the importance of integrating mathematics learning and critical thinking in financial literacy education (Wijayanti & Retnawati, 2020). The level of financial literacy among junior high school students in Indonesia remains low, particularly in areas such as personal budgeting and savings planning (Hadi & Simanjuntak, 2023; Wijayanti & Retnawati, 2020). A high percentage of students are unable to solve given problems, indicating that they face significant challenges. Although they may understand the concept of saving, they still struggle with long-term financial planning (Hadi & Simanjuntak, 2023).

Based on expert findings that mathematics anxiety, critical thinking ability, and financial literacy significantly influence students' mathematics learning outcomes, the researcher observed the phenomenon of low mathematics achievement among junior high school students in Palu City. This observation refers to the 2024 Palu City Education Report, presented in the results of the national assessment on numeracy skills, as shown in Figure 1 below.

Picture 1. National Assessment Results of Numeracy Skills Among Junior High School Students in Palu City
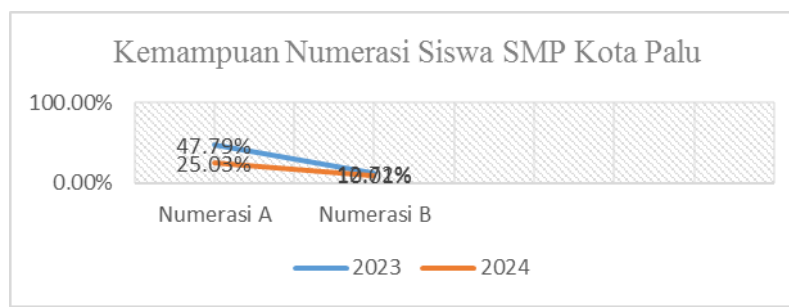
Source: Kemdikbud (2024)

Picture 1 illustrates the numeracy skills of junior high school students in Palu City in 2023 and 2024. The percentages reflect students' abilities to think using mathematical concepts, procedures, facts, and tools to solve everyday problems across various relevant contexts. Numeracy A represents students' foundational mathematical skills related to basic computation through direct equations, basic concepts in geometry and statistics, and solving simple, routine mathematical problems using analysis and evaluation. Meanwhile, Numeracy B reflects students' basic mathematical competencies related to partial mastery of concepts and computational skills necessary for decision-making in real-life situations. In 2023, the score for Numeracy A was 47.79%, and Numeracy B was 12.72%, both falling below the competency standard of 65%. In 2024, the score for Numeracy A decreased by 22.76 percentage points to 25.03%, while Numeracy B declined by 2.71 percentage points, reaching 10.01%. These results indicate that the proportion of students performing at Numeracy A and B levels in Palu City remains below the minimum competency standard.

These findings indicate a persistent gap in students' numeracy performance relative to the national standard. Such low levels of numeracy may not only reflect deficiencies in basic mathematical skills, but also deeper psychological and cognitive challenges that students face in learning mathematics. Several key factors, namely mathematics anxiety, critical thinking ability, and financial literacy, have been identified in previous research as significantly influencing students' mathematical achievement.

Mathematics anxiety is closely associated with low achievement in mathematics assessments (Nguyen, 2023). In contrast, critical thinking is directly linked to students' academic performance in mathematics, as students trained in critical thinking are better equipped to identify calculation errors,

analyze problem-solving steps, and construct more logical and accurate mathematical arguments (Fakhruddin & Nurhasanah, 2023). Moreover, there is a strong correlation between financial literacy and numeracy skills (Morris & Behrens, 2023). This is because students who are trained to understand basic financial literacy concepts, such as percentages, interest rates, and budgeting demonstrate greater ability in solving real-life mathematical problems.

As an initial step to address students' mathematics anxiety and the low levels of critical thinking and financial literacy among junior high school students in Palu City, this study aims to describe the levels and measurement properties among mathematics anxiety, critical thinking, and financial literacy. The findings are expected to provide insights and policy recommendations for the integration of financial literacy education into the school curriculum, as well as serve as a reference for teachers in designing effective classroom learning strategies.

Method

This research employed a quantitative survey method to analyze mathematics anxiety, critical thinking, and financial literacy among Grade VIII junior high school students in Palu City. The survey was designed to collect data from a sample representative of the broader population. The study utilized three instruments: a mathematics anxiety questionnaire, a critical thinking test, and a financial literacy test. Data collection was conducted offline (face-to-face) from August 12 to September 5, 2024.

The target population consisted of Grade VIII junior high school students in Palu City during the 2024/2025 academic year. Due to the large population size, a sampling method was required to ensure representative coverage. The technique used was stratified proportional random sampling, which integrates stratification based on numeracy levels and proportional allocation, followed by random sampling. The strata were determined using the 2024 Education Report, which categorized junior high schools in Palu City into three groups based on numeracy performance: high, medium, and low.

According to the 2024 Education Report, out of 76 junior high schools, 22 were classified as high-performing, 36 as medium-performing, and 18 as low-performing. The total population of Grade VIII students was 4026. Based on sample size calculation, the minimum required sample was 364 students. Assuming an average of 32 students per class, data were collected from 11 schools. The final sample was obtained by randomly selecting schools within each stratum. The final sample size consisted of 397 students, drawn from: high stratum (1 public and 2 private schools), medium stratum (4 public and 1 private school), low stratum (1 public and 2 private schools).

The data collection techniques involved both test and non-test instruments. Essay-based tests were used to assess students' critical thinking and financial literacy, while a questionnaire was used to measure mathematics anxiety. Content validity was established to ensure that the instruments accurately represented the constructs being measured. The instruments were developed based on relevant literature and validated through consultation with subject-matter experts.

A Confirmatory Factor Analysis (CFA) was conducted to examine the construct validity of the mathematics anxiety questionnaire. The fit indices obtained were as follows: CFI = 0.914, TLI = 0.910, SRMR = 0.141, and GFI = 0.902. These values meet the accepted criteria ($0.90 \leq$ CFI < 0.97, TLI $>$ 0.90, SRMR > 0.05, and $0.90 \leq$ GFI < 0.95), indicating that the model is acceptable. The CFA also showed that all items had factor loadings above 0.30, supporting the validity of the items. Additionally, the reliability coefficient (Cronbach's alpha) for the mathematics anxiety questionnaire was 0.839, exceeding the minimum standard of 0.65, thus confirming that the questionnaire is reliable for use in this study.

Results and Discussion

Based on the mathematics anxiety questionnaire data, the average levels of mathematics anxiety were obtained for schools in the high, medium, and low strata. Students in high-strata schools showed anxiety levels categorized as low to moderate, whereas those in medium- and low-strata schools fell into the moderate category. Overall, the level of mathematics anxiety among junior high school students in this study was classified as moderate, with a mean score ranging from $56 \leq \mu < 58.28$. Among the dimensions of mathematics anxiety, the cognitive aspect showed the highest mean score, indicating more intense worry or concern during thinking processes, while the somatic aspect scored the lowest, reflecting relatively fewer physical symptoms related to anxiety.

The analysis of students' critical thinking skills revealed that the average scores across all school strata (high, medium, and low) were at the same level, categorized as very low. The overall mean score of critical thinking among junior high school students in this study ranged between $22.37 \leq \mu < 25.61$, indicating a generally low capacity for analytical reasoning.

Four critical thinking indicators were assessed across all strata: identifying and understanding problems, processing and connecting information, using effective strategies, and drawing accurate conclusions. Among these, schools in the high-strata category achieved the highest scores on all indicators compared to the medium- and low-strata schools. The identifying and understanding problems indicator recorded the highest average score, suggesting that students were relatively more capable of recognizing and interpreting mathematical problems. In contrast, the drawing accurate conclusions indicator had the lowest score, indicating that most students encountered difficulties when attempting to draw valid inferences from given data. Picture 2 illustrates an example of a student's response that received a score of 1 on the inference indicator (item 3b), demonstrating a limited ability to formulate accurate conclusions.

Picture 2. Example of a Student Response Scoring 1 on the Accurate Conclusions Indicator

In the response to the indicator *drawing accurate conclusions* (item 3b), the student was able to continue the calculation based on item 3a, as the conclusion required in item 3b relies on the results obtained from the previous item. If the response to item 3a is correct, then the answer to item 3b is also likely to be accurate. However, in the example above, the student made a calculation error in item 3a, and subsequently repeated the same error when drawing a conclusion in item 3b. This affected the student's ability to draw an accurate conclusion. The student demonstrated an inability to provide a correct explanation and calculation.

The analysis of financial literacy levels revealed that schools across all strata (high, medium, and low) demonstrated similarly low performance. The average scores in each stratum fell within the low category, indicating that financial literacy among junior high school students was consistently limited regardless of school classification.. The financial literacy level was also consistently low across all school strata. The mean scores ranged from $15.62 \leq \mu < 18.92$. Picture 3 presents an example of a student's response that received a score of 1 on the indicator of applying financial knowledge and understanding (item 3b).

Picture 3. Example of a Student Response Scoring 1 on the Applying Financial Knowledge and Understanding Indikator

In the response to the indicator *applying financial knowledge and understanding* (item 3b), the student attempted to answer by continuing the calculation from item 3a. This is because the calculation in item 3b relies on the price obtained in item 3a. If the answer to item 3a is accurate, then the answer to item 3b is also likely to be accurate. However, in the student's sample response above, there was a miscalculation in item 3a, and as a result, the student used an incorrect price in the calculation for item 3b.

Based on the path analysis using SPSS 29, the effect of mathematical anxiety on critical thinking accounted for 3.3% of the variance, while the remaining 96.7% was explained by other variables outside the scope of this study. The F-test yielded a significance value of $p < 0.001$, indicating a statistically significant linear relationship between mathematical anxiety and critical thinking. The partial test also showed a significance value of $p < 0.001$, confirming a significant partial effect.

The Pearson correlation coefficient between mathematical anxiety and critical thinking was $r = -0.181$, reflecting a very weak negative correlation, although statistically significant. This suggests that while the relationship exists, its strength is minimal. The standardized path coefficient (β) was -0.257, indicating that a one-unit increase in mathematical anxiety is associated with a 0.257-unit decrease in critical thinking.

Furthermore, the path analysis revealed that critical thinking explained 10.1% of the variance in financial literacy, with the remaining 89.9% accounted for by other unmeasured variables. The F-test and partial test both showed significance values of $p < 0.001$, indicating a statistically significant direct and partial linear relationship. The correlation coefficient was $r = 0.313$, signifying a weak positive correlation. Although statistically meaningful, the influence of critical thinking on financial literacy is modest. The standardized Beta coefficient was $\beta = 0.309$, meaning that a one-unit increase in critical thinking leads to a 0.309-unit increase in financial literacy.

Additionally, the path analysis indicated that mathematical anxiety contributed 10.1% to the variance in financial literacy. While the F-test showed a significant simultaneous relationship ($p < 0.001$), the partial test returned a non-significant value ($p = 0.278 > 0.05$), suggesting no significant partial linear relationship when controlling for other variables.

The correlation coefficient between mathematical anxiety and financial literacy was $r = -0.107$, which also represents a very weak negative correlation. This means that higher mathematical anxiety is associated with slightly lower financial literacy, although the effect is minimal. The standardized Beta coefficient was $\beta = -0.074$, indicating that each unit increase in mathematical anxiety is associated with

a 0.074-unit decrease in financial literacy. The summarized results of the path analysis are presented in Picture 4.

Picture 4. Results of Path Analysis
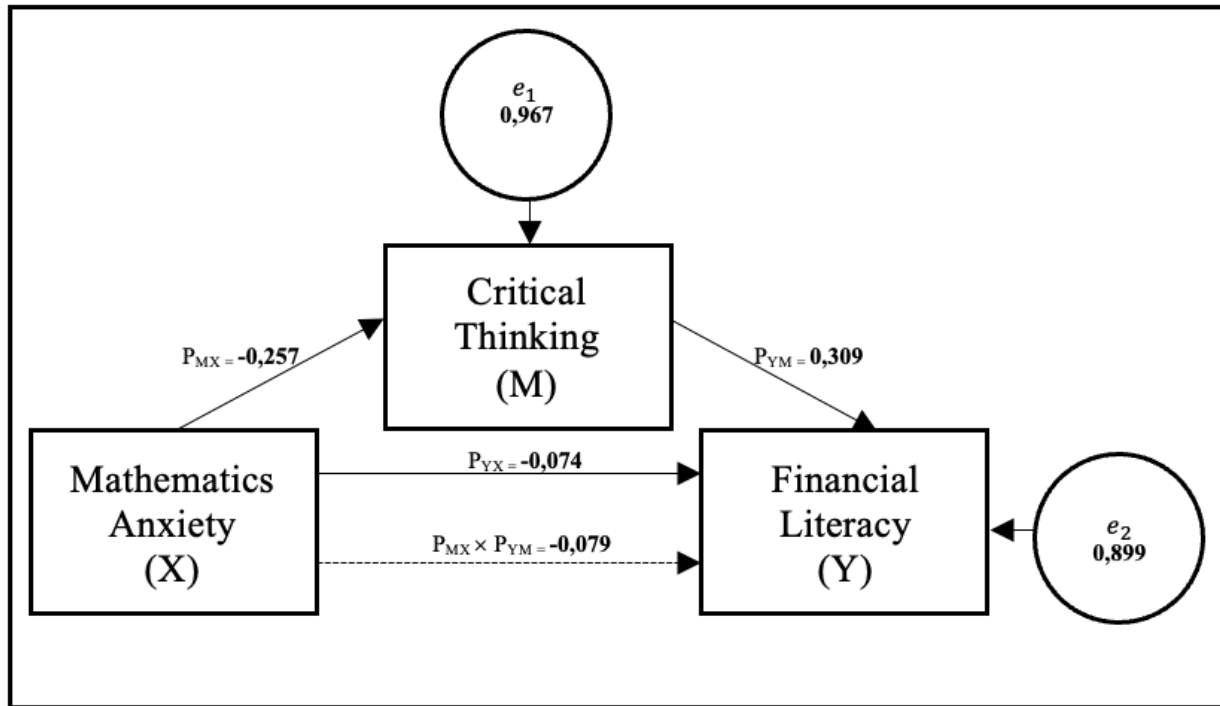
The path diagram above corresponds to the following structural equations:

$$M = 38.686 - 0.257X + 0.967 \qquad \text{(Substructural Equation 1)}$$

$$Y = 14.117 - 0.074X + 0.309M + 0.899 \qquad \text{(Substructural Equation 2)}$$

In Picture 4, the variable Mathematics Anxiety (X) has a direct statistical influence on Critical Thinking (M) with a coefficient of -0.257. This means that an increase in mathematical anxiety tends to decrease students' critical thinking abilities. Therefore, to enhance students' critical thinking skills, it is important to reduce their level of mathematical anxiety. One potential policy intervention to address this issue is the implementation of psychological support programs that promote a growth mindset, encouraging students to believe that mathematical ability can be developed through consistent practice and sustained effort. Additionally, the error term for Critical Thinking (M) indicates that 0.967 of its variance is influenced by variables outside the scope of this study.

The direct effect of Mathematics Anxiety (X) on Financial Literacy (Y) is -0.074, indicating a small negative influence. In contrast, the direct effect of Critical Thinking (M) on Financial Literacy (Y) is 0.309, suggesting a moderate positive influence. Additionally, Mathematical Anxiety (X) exhibited an indirect effect on Financial Literacy (Y) through Critical Thinking (M), with a standardized coefficient of $\beta = -0.079$, indicating a negative mediated effect. This indicates that improving critical thinking skills can contribute positively to students' financial literacy. Policy implications include integrating the development of critical thinking skills into both mathematics and financial literacy curricula to improve students' financial literacy. Teachers can design math and finance-related tasks that encourage deep and

critical thinking. These tasks may incorporate real-life contexts relevant to students, such as simulations of household budgeting or simple financial planning. Problems with multiple possible answers or those requiring analysis can help sharpen students' critical thinking abilities. Moreover, financial literacy education should also involve families, particularly in fostering basic financial understanding at home. Lastly, the error term for Financial Literacy (Y) suggests that 0.899 of its variance is explained by factors outside the current study.

Conclusion

Based on the research findings and discussion, the following conclusions are drawn:

1. The level of mathematics anxiety among eighth-grade students in Palu City is classified as moderate. Among the dimensions of mathematics anxiety, the cognitive aspect recorded the highest average score, whereas the somatic aspect had the lowest.

2. Students' critical thinking ability is categorized as very low. The highest average score was found in the identifying and understanding problems indicator, while the drawing appropriate conclusions indicator showed the lowest performance.

3. Students' financial literacy is categorized as low. The highest mean score was observed in the evaluating financial problems indicator, whereas the lowest was in the applying financial knowledge and understanding indicator.

4. The results indicate a significant negative direct relationship between mathematics anxiety and critical thinking, implying that increased mathematics anxiety tends to reduce students' ability to think critically. A significant positive direct relationship was also found between critical thinking and financial literacy, suggesting that improvements in critical thinking are associated with higher levels of financial literacy. Additionally, a negative direct relationship was identified between mathematics anxiety and financial literacy, indicating that greater anxiety is associated with lower financial literacy. Furthermore, critical thinking was found to mediate the relationship between mathematics anxiety and financial literacy, indicating an indirect negative effect, wherein high levels of anxiety may indirectly impair financial literacy through reduced critical thinking ability.

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