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The Impact of Mathematics Anxiety and Self-Efficacy Towards Prospective Mathematics Teachers' Performance

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Abstract: Mathematics anxiety is one of the serious emotional aspects that may impair the academic performance and interest in mathematics in students. This paper presents a study of the correlation between mathematics anxiety, mathematics self-efficacy, and mathematics performance among 150 future mathematics teachers in Indonesia, who were identified through purposive sampling of an undergraduate teacher education program. The Mathematics Anxiety Rating Scale- Revised (MARS-R), Mathematics Self-Efficacy Scale- Revised (MSES-R), and a self-developed Mathematics Achievement Test (MAT) were used to collect data. Pearson correlation and multiple regression were used to address the relationship and the predictive attributes of these variables. Descriptive analysis indicated that participants had moderately high mathematics anxiety (M = 82.4, SD = 15.2), moderately high self-efficacy (M = 72.8, SD = 12.5), and good performance (M = 78.3, SD = 10.7). Pearson correlation analysis revealed a negative correlation between mathematics anxiety and performance ($r = -0.62$, $p < 0.001$). In contrast, self-efficacy had a positive correlation with performance ($r = 0.6$). Regression analysis showed that both anxiety ($\beta = -0.45$, $p < 0.001$) and self-efficacy ($\beta = 0.49$, $p < 0.001$) were significant predictors. The results of the multiple regressions showed that the model was significant, $F(2, 147) = 68.24$, $p < 0.001$, and accounted for 55.7% of the variance in performance ($R^2 = 0.557$). Anxiety (B =-0.45) and self-efficacy (B =0.49) were both significant predictors of performance (B = -0.45, t = -7.62 p = 0.001) and self-efficacy (B = 0.49, t = 8.15, p = 0.001) turned out to be the stronger predictors. The practical implications of these findings are most significant, as strategies aimed at diminishing mathematics anxiety and enhancing self-efficacy should be the primary focus of mathematics teacher education programs, as these aspects directly relate to the competency and confidence of future teachers in teaching mathematics.

Keywords: mathematics anxiety, self-efficacy, academic performance, future mathematics teachers, mathematical confidence, mathematical teacher education.

▪ INTRODUCTION

Mathematics is still one of students' most anxiety-provoking courses from primary through higher education. Anxiety and avoidance in mathematics is now reported much more widely as a widespread international phenomenon, with studies only recently revealing its corrosive influence on performance and motivation, not just across but within cultures. For instance, in the USA, mathematics anxiety is a factor influencing long-lasting gender differences and poorer performances in mathematics (Ganley et al., 2019). Students in Spain who experienced high levels of anxiety showed notable reductions in their ability to solve problems and perform well on tests (Perez-Fuentes et al., 2020). Similarly, mathematics anxiety has been found to impair working memory and decrease perseverance in learning tasks in China (Liu, 2023). Additionally, it has been strongly associated with avoiding mathematics-related courses and having less confidence in STEM pathways in Turkey (Ibrahimoglu, 2018). These studies collectively demonstrate that mathematics anxiety is consistently linked to decreased participation in

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STEM pathways, lower achievement, and avoidance of mathematics-related tasks (Rozgonjuk et al., 2020). Avoidance behaviors, decreased persistence, and cognitive interference that impairs working memory and reasoning processes are common traits of students with high anxiety (Dowker et al., 2019; Ramirez et al., 2013). This emotional strain restricts access to higher education and STEM-related careers and contributes to ongoing gaps in mathematical achievement (Daker et al., 2021; Ongcoy et al., 2023).

Numerous theoretical frameworks have been used to gain insights into mathematics anxiety. The Attentional Control Theory (Eysenck et al., 2007) posits that anxiety reduces an individual's attentional capacity for cognitive tasks due to the intrusion effect caused by intrusive thoughts, which consume a significant portion of mental capacity. This disruption affects the ability to process information, particularly in solving multi-step mathematical problems. Similarly, the Cognitive Interference Theory posits that anxiety is a source of internal interference that disrupts the rational stream of thought, leading people to make procedural errors despite possessing adequate conceptual knowledge. These frameworks are the reason that, despite understanding the concepts behind the problems, students with high mathematical worries often find it hard to solve a problem.

Mathematics self-efficacy is a key motivational factor that has been noted to cause engagement and persistence of learners alongside anxiety. Self-efficacy, as proposed by Bandura's Social Cognitive Theory, refers to the confidence students have in their ability to succeed; it is closely linked to performance outcomes (Bandura, 2014). Increased self-efficacy enables learners to implement more effective coping strategies, persist in the face of difficulties, and manage their emotions more effectively, thereby counteracting the negative consequences of anxiety (Namkung et al., 2025; Pei et al., 2025). Considering the Cognitive Load Theory, high anxiety uses working memory resources, and effective use of cognitive capacity to solve problems is supported by strong self-efficacy.

Recent empirical studies have emphasized the protective nature of self-efficacy in mathematics learning. Growth mindset-based interventions and adaptive coping mechanisms have been found to have a potent effect on mathematical self-efficacy, which subsequently has a positive impact on academic performance (Magnate & Sulatra, 2023). This means that the development of self-efficacy may be a strong counteracting factor to the harmful impacts of mathematics anxiety, especially where high-stakes learning is involved.

Likewise, previous studies have revealed that more nervous students are less likely to report enjoying math, have motivation and confidence, and will avoid courses related to mathematics (Ashcraft & Moore, 2009; Hoffman, 2010). Self-efficacy, in turn, is not just a predictor of academic success but also a sort of emotional control that allows for reducing the negative effect of anxiety on learning (Honicke & Broadbent, 2016; Perez-Fuentes et al., 2020). The relationship between mathematics anxiety, self-efficacy, and performance has been noted to be cyclical, and this has recently drawn scholarly attention. The low performance may increase anxiety, which results in weakened self-efficacy, which in turn undermines further performance (Zivkovic et al., 2023). On the other hand, mastery experiences and academic success boost self-efficacy and decrease anxiety, not to mention increasing resilience during learning (Kaskens et al., 2020). The cyclical dynamic revealed that successful interventions to decrease anxiety or enhance efficacy can utilize reinforcing loops that lead to long-term improvements in mathematics outcomes.

Although this is a growing body of international research, the literature on the role of mathematics anxiety and self-efficacy when used together in the context of prospective teachers remains scarce, especially in Indonesia. Although past studies typically targeted broad categories of students or revealed these factors individually (Siswanti & Djalal, 2018), they did not analyze the relationship between them in terms of predictive outcomes in teacher education. Furthermore, the role of culturally modified instruments in capturing the subtle vibonic interaction between emotional and motivational factors in non-Western contexts has received minimal attention. The current research achieves this by filling gaps in the literature by examining the same variables (nothingness) of anxiety and self-efficacy among Indonesian potential mathematics teachers to bring context-related information about how the two variables contribute to predicting performance and provide suggestions on how to incorporate them in designing teacher education programs that can produce confident and effective teachers.

This issue is critical in the context of teacher education in Indonesia. It is assumed that future mathematics educators should not only be familiar with their material but also be able to teach it effectively and confidently. Teacher-to-teacher-transmitted mathematics anxiety may manifest itself through a tense instructional style. In contrast, teachers who are well self-efficacious tend to use a more creative pedagogical style, encourage active involvement, and create a positive student classroom environment. Therefore, discussing the concepts of mathematics anxiety and self-efficacy among Indonesian pre-service teachers is crucial in formulating culturally sensitive and pedagogically sound interventions. Based on this background, the present study seeks to answer the following research questions:

1. What is the relationship between mathematics anxiety, mathematics self-efficacy, and mathematics performance among prospective mathematics teachers?
2. To what extent do mathematics anxiety and self-efficacy predict prospective teachers' performance?
3. Which variable serves as the stronger predictor of mathematics performance?

▪ METHOD

Participants

The sample consisted of 150 undergraduate students enrolled in a Mathematics Education course at Universitas Negeri Surabaya, one of Indonesia's most prominent public universities that trains a large number of future mathematics teachers. The purposive sampling technique was used due to the fact that the target population, which was prospective mathematics teachers, was the most important in investigating mathematics anxiety and self-efficacy in relation to teacher preparation. The choice of this institution was because it offers full coursework in mathematics combined with pedagogy. Thus, the students will be best suited to examine the interaction of affective and cognitive variables in learning mathematics. The sample consisted of 80 male and 70 female students in the second to sixth semesters, with an age range of 18 to 23 years. This allocation facilitated diversity in both academic experience and gender. Moreover, the ethical considerations were adhered to throughout the process: participation was voluntary, informed consent was obtained, and the anonymity and confidentiality of responses were ensured.

Research Design and Procedure

The research design adopted in the study was a quantitative correlational research design. The correlational approach was suitable because it enabled the establishment of natural relationships between psychological and academic constructs in their natural forms without any manipulation. The decision in favor of this design can be explained by the understanding that emotional and cognitive-motivational factors work in tandem to determine the results of mathematics learning. The data collection took place over a period of two weeks, around mid-semester, when students were busy with coursework and had sufficient exposure to mathematics-related activities. Informed consent was obtained after the participants were informed about the study's objectives. Google Forms were used to distribute the MARS-R and MSES-R questionnaires online, which implies accessibility and anonymity. The assessment was conducted in a controlled classroom using the Mathematics Achievement Test (MAT) and printed test papers to ensure standardization and consistency. Clear guidelines were provided, and no strict time constraint was imposed. The atmosphere was carefully crafted to be relaxing and conducive to reducing the anxiety that the test may have caused.

Instruments

The instruments used were the Mathematics Anxiety Rating Scale-Revised (MARS-R), Mathematics Self-efficacy Scale-Revised (MSES-R), and Mathematics Achievement Test (MAT). MARS-R and MSES-R were translated into English and then back-translated into English, and subsequently adapted. Two mathematics education experts translated the instruments into the Indonesian Language. This was followed by a back-translation in English by an independent translator to ensure semantic equivalence. The items were reviewed by a panel of three experts based on their cultural and contextual relevance. A pilot test was then conducted on 30 mathematics education students not part of the main sample, resulting in some minor changes to facilitate clarity.

The MAT was designed to specifically assess students' ability to solve geometry problems. The test items were directly adapted from the mid-semester exam in the Analytic Geometry course, which all participants had already completed. This test consisted of a multiple-choice problem-solving section comprising 20 structured questions on analytic geometry, coordinate systems, and geometric transformations. To ensure validity, the items were reviewed by two course lecturers and one mathematics education specialist to verify that they aligned with the course objectives and cognitive requirements.

Data Analysis

The obtained data were processed with SPSS version 28 software. The level of mathematics anxiety, self-efficacy, and performance of the participants were summarized using descriptive statistics (mean, standard deviation, range). The bivariate relationships between the variables were analyzed to determine the Pearson correlation. To establish predictive effects, a multiple linear regression analysis was performed to identify the roles played by mathematics anxiety and self-efficacy in relation to mathematics performance.

Statistical Assumptions

Several assumptions were tested prior to conducting correlation and regression analyses. Shapiro-Wilk tests and Q-Q plots were used to assess the normality of the

distributions, which showed that the distributions were approximately normal. The linearity was also verified by plotting scatter plots that showed linear relationships between predictors and outcomes. The measure of homoscedasticity was through the residual plots, where no heteroscedasticity was observed. The Multicollinearity was assessed in terms of the Variance Inflation Factor (VIF) and tolerance; their VIF scores were all lower than 5, which is deemed to be appropriate. The independence of the errors was tested using the Durbin-Watson statistic, and the result was close to 2, indicating that the errors are not autocorrelated. Boxplots, standardized residuals, leverage values, and Cook's Distance were used to check potential outliers. All y no residuals were more than ±3, and Cook D values were less than 0.5, suggesting the lack of highly influential cases. Thus, the final analysis of all 150 participants was kept.

Validity Test

The instrument was tested for content and construct validity. Content validity was conducted by a panel of experts (two mathematics teachers and one psychometric expert) using a translation-back-translation procedure and a pilot test on 30 students. In addition, construct validity was assessed using item-total correlations (product-moment correlations) at a 5% significance level. The analysis revealed that all nine items of the Mathematics Anxiety Questionnaire exhibited a significant correlation with the total score (r between 0.299 and 0.701, $p < 0.05$), indicating that all were deemed valid. For the Self-Efficacy Questionnaire, sixteen of the seventeen items met the validity criteria with R values between 0.210 and 0.580 ($p < 0.05$). In contrast, one item (item 15) was found to be invalid ($p = 0.075$) and was therefore excluded from the reliability analysis (Taherdoost, 2016).

Reliability

Reliability was evaluated using Cronbach's Alpha. The Mathematics Anxiety Questionnaire yielded an α value of 0.683 for the nine-item scale, indicating moderate reliability. A total of 16 items, the alpha coefficient for the Self-Efficacy Questionnaire was 0.734, indicating a good internal consistency (Hinton, 2024). Although both values are lower than the formally recommended cut-off score of 0.80 for internal consistency, alpha coefficients above 0.60 have been considered acceptable in socio-behavioral education research (Bormann et al., 2020; Calik Kutukcu et al., 2021; Zakariya, 2022). Therefore, both instruments are reliable and good for this study.

Statistical Assumption Tests

Before performing inferential statistics, classic assumption testing was carried out. The results showed that the data were normally distributed (Shapiro–Wilk: $p > 0.05$ for all variables), a linear relationship existed among the variables (as indicated by the scatterplot distribution), and no heteroscedasticity was observed (as evidenced by an even residual plot). The multicollinearity test also revealed no multicollinearity, as the VIF values were all less than 5 (Anxiety = 2.07; Self-Efficacy = 2.11; tolerance > 0.45). The Durbin–Watson value of 1.92, which was close to 2, confirmed the absence of autocorrelation. In addition, outlier detection with standardized residuals and Cook's Distance revealed no influential cases in which all residuals were between − 3 and + 3, and Cook's $D < 0.20$. Therefore, all assumptions of regression were fulfilled.

▪ RESULT AND DISSCUSSION

Descriptive Statistics

Table 1 depicts the descriptive statistics of mathematics anxiety, self-efficacy, and performance. The respondents indicated that the average mathematics anxiety was 82.4 (SD = 15.2), which implied an average level of mathematics anxiety. The average score for self-efficacy was 72.8 (SD = 12.5), indicating a fairly high level of confidence in mathematical problem-solving. The performance in mathematics ranged from 45% to 95%, with an average of 78.3% (SD 10.7), indicating generally good competence. The gap between the levels of self-efficacy and anxiety, on the other hand, is indicative of a possible psychological inhibitor to optimum performance. The results of the current study indicate that the Indonesian pre-service teachers have higher anxiety levels in comparison with (Ramirez et al., 2013), who have lower average scores of anxiety (M ≈ 70), which is probably caused by a high exam-oriented culture and a performance-based learning environment.

Table 1. Descriptive statistics of study variables

Variable	Mean	SD	Minimum	Maximum
Mathematics Anxiety	82.4	15.2	45	110
Mathematics Self-Efficacy	72.8	12.5	50	100
Mathematics Performance	78.3%	10.7	45%	95%

Such averages indicate that the self-efficacy levels are rather high, but the anxiety levels are high and can be negatively affecting performance. The results of our study indicate that Indonesian teacher candidates have higher levels of anxiety, which might lead to the high level of negative correlation here. These findings are also crucial in pointing to a paradoxical scenario, since pre-service teachers are confident in their mathematical capability, but this does not help them counter the harmful consequences of high anxiety. Ashcraft & Moore (2009) have also reported similar inconsistencies by stating that affective affect of anxiety can shed light on cognitive strengths. In this regard, the Indonesian pre-service teachers can be a peculiar group where self-efficacy has been relatively advanced. However, it is still repressed under the influence of situational stressors. This paradox presents a valuable point of entry for teacher education programs to develop interventions specifically designed to reduce anxiety, rather than relying solely on improving efficacy beliefs.

Performance Trends

A specially designed mathematics performance test was administered as part of the study. The test results indicated that students who were more anxious in mathematics consistently scored lower compared to their less anxious counterparts. This trend is further evident in a sample performance assessment of the test given in a geometry course of analytic course. The test results are presented in Figure 1 below.

The results of the test have identified some trends that are correlated with the degrees of anxiety in students. Students with reported elevated mathematics anxiety often left out parts of the problem-solving and committed procedural mistakes. These errors are attributed to the Cognitive Interference Theory (Eysenck et al., 2007), which postulates that the development of anxiety occupies the working memory resources, and as a result,

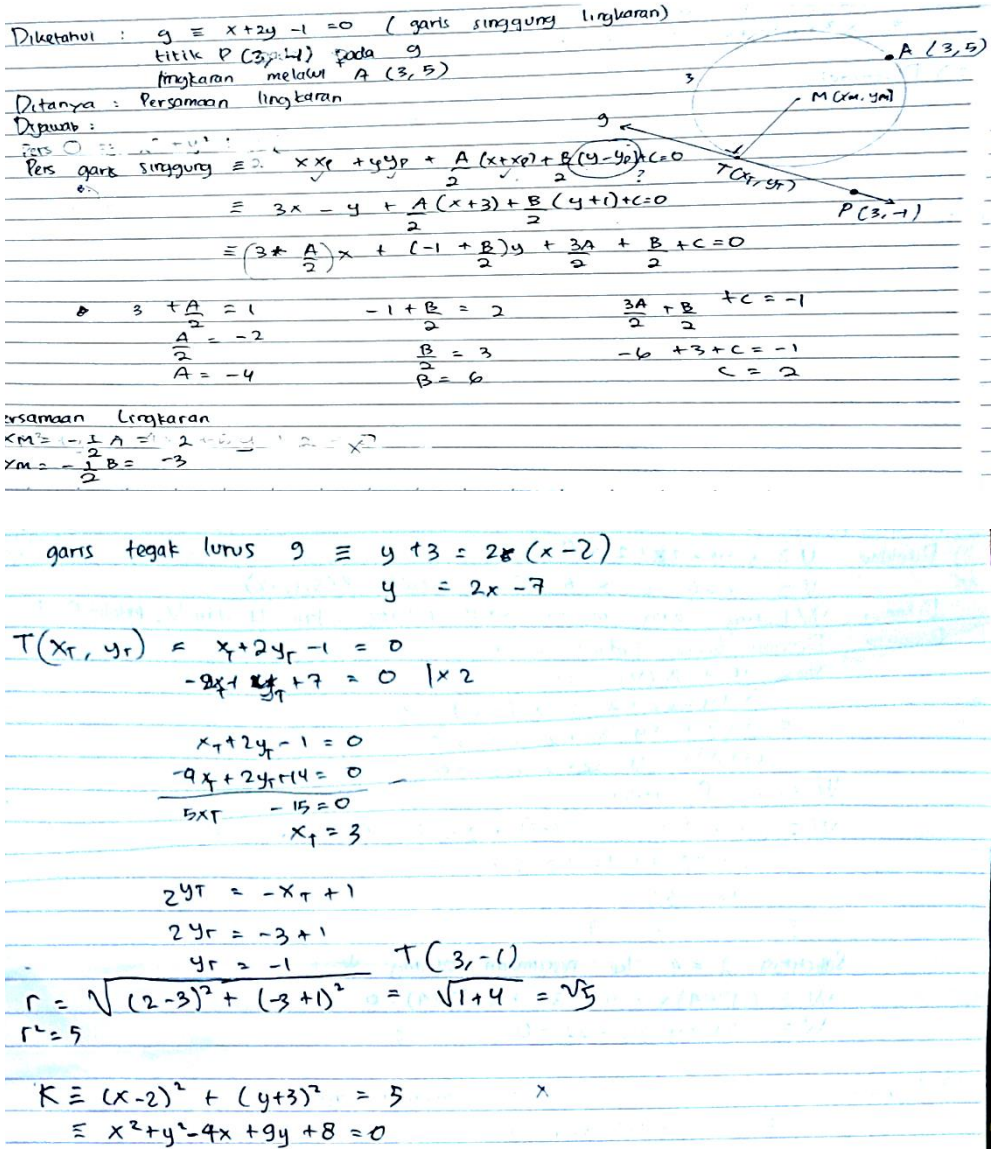

Figure 1. Geometric analytic problem with large anxiety student responses

are fewer attentional resources to engage in logical sequencing. This is why nervous students were unable to cope with multi-step problems in geometry. Such students typically demonstrated an inability to apply geometrical concepts with precision, indicating that they struggled to focus their attention and solve problems involving multiple steps. Further, less mathematics-anxious students were more persistent and more accurate in solving complex tasks. They seemed to be more eager to get involved in difficult work and apply logical reasoning and systematic methods. This comparison highlights the cognitive cost of anxiety on working memory and executive functioning, which is essential in mathematical procedures to be successful.

Surprisingly, qualitative differences in the problem-solving strategy were also observed in the analysis of student performance. Students with high anxiety were more prone to surface-level strategies, like memorized formulas or shortcuts, and less prone to deeper conceptual reasoning. They were less hesitant to attack problems unfamiliar to

them. This trend can be echoed by Perez-Fuentes et al., (2020) who observed that anxiety causes students to turn towards less efficient strategies. In this way, as well as decreasing accuracy, anxiety determines the nature of the cognitive strategy applied while working on mathematical problems.

Correlation Analysis

The Pearson correlation analysis revealed significant relationships between the variables in the study. Table 2 shows the Pearson correlation coefficients between the three variables of the study. As can be seen, there was a significant negative correlation between mathematics anxiety and self-efficacy ($r = -0.71$, $p < 0.001$), meaning that students with higher levels of mathematics anxiety are less likely to believe they can succeed in mathematics. On the same note, academic performance was found to be negatively correlated with mathematics anxiety ($r = -0.62$, $p < 0.001$), and thus, the higher the level of anxiety, the lower the student scores in mathematics. Mathematics self-efficacy, on the other hand, had a positive relationship with mathematics performance ($r = 0.68$, $p < 0.001$), indicating that students with higher mathematics self-efficacy are more likely to achieve better academic results. These correlations give preliminary empirical support to the hypothesized mediating role of self-efficacy in the correlation between anxiety and performance. Consequently, these results indicate that self-efficacy provides the protective influence, as a mediator of the negative impact of anxiety on performance.

Table 2. Pearson correlation matrix

Variable	1	2	3
Mathematics Anxiety	1.00	-0.71	-0.62
Mathematics Self-Efficacy	-0.71	1.00	0.68
Mathematics Performance	-0.62	0.68	1.00

To further the test, a mediation model (Anxiety, Self-Efficacy, and Students' Performance) was employed using the PROCESS Macro (Model 4). Findings showed that there was a significant indirect influence of mathematics anxiety on performance via self-efficacy (indirect effect = -0.35, 95% CI [-0.47, -0.24]). This implies that anxiety weakens performance partially; it depletes self-efficacy. Self-efficacy was a partial mediator, despite the direct effect remaining significant. Our findings indicate a positive mediating effect, which is stronger than that of Usher & Pajares (2009), who found an indirect effect of about 8.2 times weaker (β 0.20), possibly because the cultural focus on exam outcomes in Indonesia increases the degree of anxiety-efficacy relationship.

The size of such correlations is also significant; it is not insignificant but much higher than normally reported in Western samples (Dowker et al., 2019). This can be an indicator of structural and cultural variations within the Indonesian educational system, where performance is a major focus and any error can be stigmatized. These conditions can also increase the emotional salience of mathematics, which enhances the negative correlation between anxiety and achievement. The positive relationship between self-efficacy and performance is also stronger than predicted, which further indicates that undue pressure in the situation makes a strong belief in personal capabilities particularly essential in maintaining motivation and perseverance.

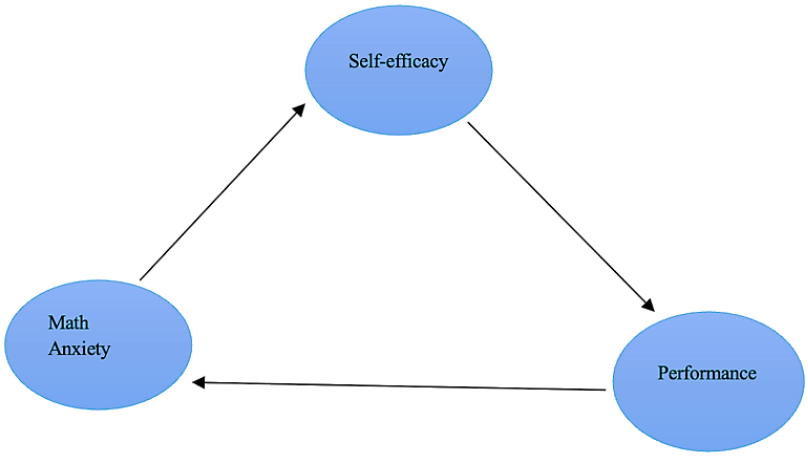

Figure 2. Process macro model 4

Multiple Regression Analysis

A multiple regression analysis was done to further examine the predictive effects of mathematics anxiety and self-efficacy on student performance. The regression model was significant (F(2,147) = 68.24, p < 0.001), and resulted in the explanation of the variation (55.7) of mathematics performance (R 2 = 0.557). The two predictors played an important role in the model. Mathematics anxiety had a negative relationship (045, t - 7.62, p = 0.001), which confirms its negative impact on performance. On the other hand, mathematics self-efficacy emerged as a robust positive predictor (8.15, p = 0.001), underscoring the importance of self-belief in enhancing students' academic performance. The findings show that anxiety is a negative effect on performance, but self-efficacy can be used as a buffer effect to reduce the negative impact of emotional distress.

Table 3. Multiple regression analysis summary

Predictor	**β**	**t**	**p**
Mathematics Anxiety	- 0.45	- 7.62	< 0.001
Mathematics Self-Efficacy	0.49	8.15	< 0.001

Table 3 presents a comparative description of students' performance in mathematics based on their self-reported anxiety levels. The statistics reveal clearly that students with high anxiety recorded very low average scores (M = 69.2%) than those with low anxiety levels (M = 86.4%). In addition, qualitative observations using test papers provided by students confirmed that high-anxiety participants commonly committed procedural mistakes, omitted steps, and showed disorientation in the application of geometrical/algebraic ideas. On the contrary, learners who had low anxiety levels were more organized in their problem-solving strategies, more precise, and more persistent in working on complex tasks. Such results confirm the cognitive interference model (Eysenck et al., 2007), which states that anxiety interferes with working memory and attention, both of which are crucial for performing mathematical reasoning successfully.

The regression plot in Figure 3 indicates a strong positive linear relationship between mathematics self-efficacy and mathematics performance. The trend of information points rising confirms that the higher the confidence students have in their mathematical skills, the higher their academic performance is expected to be. This

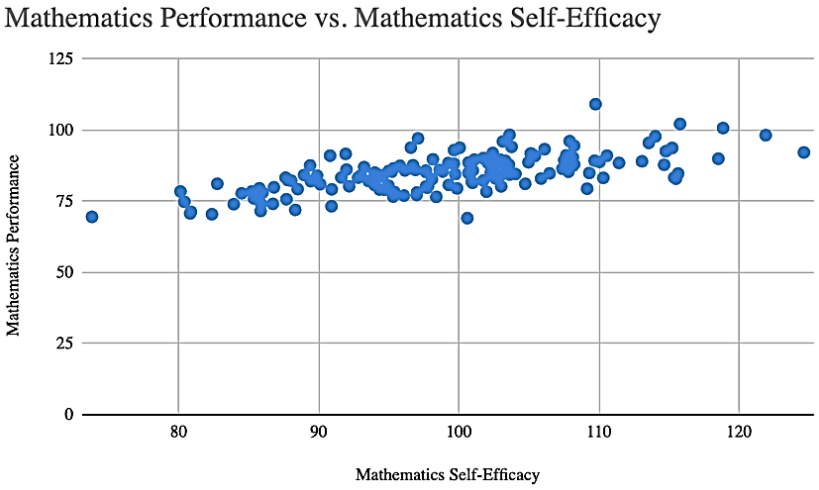

Figure 3. The regression plot

observation is consistent with the multiple regression outcome (0.49, $p < 0.001$), which revealed that self-efficacy had a significant positive effect on achievement. The graphical image supports the statistical data, indicating that learners who believe they can achieve success in mathematics are more likely to be involved in learning activities and are more persistent and accurate in their work.

Another suggestion from the regression analysis is that interventions focusing on self-efficacy might have disproportionately high returns regarding performance improvement. Since self-efficacy directly facilitates achievement and indirectly protects against anxiety, fortifying this psychological construct may be an extremely effective approach in teacher education programs. This finding is similar to that of Jameson et al. (2022), which demonstrated the effectiveness of interventions based on self-efficacy in enhancing confidence and test scores in high-anxiety students.

The practical implications of these findings are significant. The interventions that should be incorporated into teacher education programs should be associated with developing mastery experiences, reflective feedback, and peer models to foster self-efficacy. These practices may help decrease the level of mathematics anxiety and, at the same time, increase the confidence of teacher candidates. These results are in line with Magnate & Sulatra (2023), who revealed that interventions based on a growth mindset were effective in enhancing self-efficacy and performance in math. Through the inclusion of such practices in teacher training programs, educators will be helped to produce future educators who are not merely strong in mathematics but also well-equipped to handle emotional demands.

The findings are consistent with Ashcraft & Moore (2009) and Ramirez et al. (2013), but with greater effect sizes, indicating that anxiety has a more debilitating effect and efficacy is more helpful to Indonesian teacher candidates. This can be attributed to the fact that the Indonesian education system emphasizes high-stakes testing, while low mastery-based learning opportunities hinder the development of self-efficacy. This dual dynamic may be even enhanced by cultural views of mathematics as prestigious and challenging (Octoria et al., 2024). The practical implications of these results include that teacher education programs should focus on providing mastery experiences, reflective

feedback, and peer modeling to enhance teachers' efficacy beliefs. In this way, they can assist future teachers not only in overcoming their anxiety but also act as role models to students.

This study is characterized by several limitations. To begin with, the sample size was based on a single university of higher education, which can restrict the generalizability of the results to other teacher education settings. Second, self-report measures are susceptible to response bias, and the cross-sectional structure limits the ability to draw cause-and-effect conclusions. Third, despite conducting mediation analysis, the design is not capable of fully capturing the cyclical aspect of relationships among anxiety, self-efficacy, and performance. Future studies to overcome these shortcomings should, first, use cross-sectional or longitudinal designs to determine causal relationships by replicating the study in various institutions. Interventions, including cognitive reappraisal training to reduce anxiety or mastery learning modules to increase self-efficacy, could be tested using randomized controlled trials (RCTs). Additionally, cross-cultural studies involving comparative analysis would also aid in examining the moderating effects of systems and culture on the relationships between anxiety, efficacy, and performance. Lastly, qualitative methods, such as interviews and classroom observations, may have provided more information about the lived experiences of teacher candidates who have been subject to quantitative analysis, thereby further enriching the policy implications and educational training of educators.

▪ CONCLUSION

The report highlights the importance of mathematics self-efficacy in enhancing the performance of prospective teachers and simultaneously mitigating the adverse effects of mathematics anxiety. The results validate the hypothesis that, despite the considerable role anxiety plays as an emotional barrier in mathematics learning, persistence, effective problem-solving skills, and academic resilience can be promoted by a high level of self-efficacy. This lends weight to the idea of not focusing solely on cognitive aspects, but also on the affective aspects of mathematics education. The findings contribute to an accumulating body of literature emphasizing the need for teacher education programs to comprehensively incorporate psychological empowerment techniques as part of professional preparation, enabling future educators to be competent and comfortable in leading students.

This research has certain implications, especially for teacher education in mathematics in Indonesia, where exam-based models as well as traditional pedagogy tend to enhance anxiety and limit the way to build self-efficacy. To achieve mastery, peer collaboration and reflective practices must be emphasized in teacher education programs to foster competence and confidence in pre-service teachers. This study, however, is constrained by the use of a single-institution sample, self-report measures, and a cross-sectional design, which limits causal interpretation. The longitudinal or experimental design should be implemented in several institutions in future studies to investigate the cyclic association between performance, self-efficacy, and anxiety. Comparative cross-cultural analysis can also lead to an understanding of how systemic and cultural contexts shape these dynamics, and qualitative research can reveal the lived experiences underlying quantitative trends. Finally, it is necessary to train knowledgeable mathematics teachers, but more importantly, emotionally strong, to raise the future

generation of students who will see mathematics as something that is not only accessible but also empowering.

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