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ORIGINAL RESEARCH ARTICLE

The Relationship of Self-Regulation and Teaching Efficacy to Mathematics Teaching Anxiety among Mathematics Pre-Service Teachers

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ABSTRACT

Mathematics teaching anxiety may affect future teachers' instructional preparedness. This study aimed to determine whether self-regulation and mathematics teaching efficacy significantly predict mathematics teaching anxiety among pre-service mathematics teachers. A quantitative, cross-sectional, descriptive-correlational design was used, involving 78 pre-service mathematics teachers who underwent field-based training and completed adapted, validated instruments. Multiple regression analysis examined the predictive contribution of self-regulation and teaching efficacy to mathematics teaching anxiety. Results showed a significant regression model, with teaching efficacy emerging as a significant predictor, while self-regulation did not contribute significantly to the model. The predictors explained 26.3% of the variance in mathematics teaching anxiety ($R^2 = .26$, $p = .001$). These findings suggest that teaching efficacy is an important factor associated with mathematics teaching anxiety and may inform teacher education programs by supporting targeted strategies to strengthen pre-service teachers' professional preparedness..

Keywords: *Mathematics education, mathematics teaching anxiety, pre-service teachers, self-regulation, teaching efficacy*

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INTRODUCTION

Mathematics teaching anxiety is a pressing issue among pre-service teachers that can negatively affect their ability to deliver effective instruction. It often manifests as discomfort, worry, and fear when teaching mathematics, leading to reduced confidence and poorer classroom performance. This concern arises from various factors identified in the literature, such as limited mastery of mathematical concepts, unsupportive learning environments, low technological competence, and poor self-confidence (Prasetyo et al., 2023). As mathematics remains one of the most challenging subjects for both teachers and learners, addressing teaching anxiety becomes a crucial step in preparing competent and confident educators for the future (Gresham and Burleigh, 2019).

Globally, research has shown that mathematics teaching anxiety is shaped by factors such as limited mastery of concepts, unsupportive environments, and low confidence. In the Philippine context, studies also highlight the importance of pedagogical preparation, reflective practice, and mentoring in reducing anxiety. This study is anchored on three established theoretical frameworks. First, Bandura's (1997) Social Cognitive Theory explains teaching efficacy as belief in one's ability to organize and execute the actions required to manage teaching tasks successfully. Second, Zimmerman's (2002) Cyclical Model of Self-Regulated Learning describes how individuals plan, monitor, adjust, and reflect on their actions to achieve goals, a process directly aligned with instructional practice. Third, the Mathematics Teaching Efficacy Beliefs framework developed by Enochs et al. (2000) distinguishes between Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectancy (MTOE), central constructs for understanding teachers' confidence in mathematics instruction. Together, these frameworks explain how beliefs, self-management processes, and instructional expectations interact and may relate to mathematics teaching anxiety among pre-service teachers.

This study integrates Bandura's Social Cognitive Theory (1997), Zimmerman's Self-Regulated Learning Model (2002), and Enochs et al.'s (2000) Mathematics Teaching Efficacy Beliefs framework. Bandura's theory explains how capability beliefs influence performance and emotional responses. Zimmerman's model explains how individuals manage their actions through planning, monitoring, adjusting, and reflecting. The MTEBI framework explains how personal teaching confidence (PMTE) and beliefs about the impact of teaching on student outcomes (MTOE) shape instructional behaviour. Together, these frameworks provide a foundation for examining how self-regulation and teaching efficacy relate to mathematics teaching anxiety among pre-service teachers.

In teaching, self-regulation extends beyond academic learning to include emotional control, instructional decision-making, and adaptive classroom practices. Empirical studies

have shown that teachers with strong self-regulation skills demonstrate greater resilience, improved classroom management, and reduced susceptibility to stress and anxiety (Zimmerman, 2002; Gresham and Burleigh, 2019). These skills enable pre-service teachers to effectively cope with instructional challenges, sustain motivation, and adjust strategies in real time, thereby mitigating the effects of teaching anxiety (Gresham and Burleigh, 2019). Research highlights that mathematics teaching anxiety is prevalent across teacher education programs (Gresham and Burleigh, 2019; Taley et al., 2021; Tunç-Pekkan et al., 2022). Guided by these theoretical perspectives, this study assumes that teaching efficacy and self-regulation serve as key psychological mechanisms that are negatively associated with mathematics teaching anxiety. Teaching efficacy shapes how pre-service teachers perceive their instructional capabilities, while self-regulation determines how effectively they manage the cognitive and emotional demands of teaching. Together, these constructs are expected to interact, influencing anxiety levels among pre-service teachers.

In Ghana, pre-service teachers' anxiety levels were found to be linked to mathematics achievement and field experiences (Taley et al., 2021). Similarly, a study in Turkey revealed that evaluation and classroom observation during training heightened mathematics teaching anxiety among pre-service teachers (Tunc-Pekkan et al., 2022). In the Philippine context, several studies emphasize that confidence, problem-solving ability, pedagogical preparation, and reflective practice significantly influence mathematics-related anxiety among pre-service teachers. Additionally, broader Philippine-based research affirms that confidence, problem-solving ability, and critical thinking skills are crucial factors in reducing anxiety levels (Pentang et al., 2023). Recent Philippine-based studies further emphasize the importance of examining mathematics teaching anxiety within the local teacher education context. Gorospe (2022) found that teaching self-efficacy significantly influences teaching anxiety and teaching performance among Filipino pre-service teachers. The study highlighted that even when content knowledge is adequate, limited instructional confidence contributes to heightened anxiety levels.

Similarly, Pentang et al. (2023) reported that mathematics avoidance among Filipino elementary pre-service teachers is strongly associated with problem-solving performance and subject preference. Their findings suggest that low confidence in mathematical reasoning may translate into anxiety when teaching the subject. Tongol (2024) further identified emotional intelligence and exposure to professional development as significant factors influencing mathematics teaching anxiety among pre-service teachers in the Philippines. The study emphasized that contextual realities such as classroom observation, evaluation systems, and performance expectations intensify anxiety during internships.

In addition, Philippine teacher education research highlights the importance of reflective practice and mentoring in strengthening teaching efficacy and emotional preparedness. Studies in local teacher education institutions underscore that structured internship programs and guided supervision build instructional confidence and reduce anxiety (Pentang et al., 2023). These Philippine-based findings demonstrate that mathematics teaching anxiety is not merely an imported theoretical issue but a locally relevant concern shaped by contextual, institutional, and psychological factors. Therefore, investigating self-regulation and teaching efficacy in relation to mathematics teaching anxiety in the Mindanao context offers meaningful, localized contributions to teacher education research.

Despite these findings, there remains a lack of comprehensive investigation into how self-regulation and teaching efficacy, two important psychological and pedagogical constructs, directly influence mathematics teaching anxiety in the local context, particularly in Mindanao. Several frameworks suggest that teaching efficacy, the belief in one's ability to effectively teach mathematics, and self-regulation, the capacity to control emotions, behaviours, and learning strategies, are essential predictors of teaching performance and confidence. Past literature indicates that higher teaching efficacy can mitigate the negative effects of anxiety, while strong self-regulation skills allow pre-service teachers to cope better with teaching challenges (Tongol, 2024). However, existing studies have not sufficiently explored how these two constructs interact with mathematics teaching anxiety, especially among pre-service teachers in Davao de Oro. Establishing this connection is vital to design intervention strategies that enhance teacher preparation and professional growth.

Therefore, this study aims to determine whether self-regulation and teaching efficacy relate to mathematics teaching anxiety among mathematics pre-service teachers in Davao de Oro State College. Specifically, it examines the levels of self-regulation, teaching efficacy, and mathematics teaching anxiety and identifies whether these variables significantly correlate. By addressing these objectives, the study provides insights that inform the development of targeted teacher education programs and professional support systems designed to foster confident, resilient, and effective mathematics educators.

MATERIALS AND METHODS

Description of the study area

The study was conducted in a state college in Davao de Oro, Philippines, offering the Bachelor of Secondary Education (BSED) major in mathematics during the school year 2024–2025.

Research design

This study employed a quantitative approach to examine the relationships among self-regulation, teaching efficacy, and mathematics teaching anxiety among mathematics pre-service teachers. In this design, quantitative data were collected concurrently, analyzed independently, and integrated during interpretation to provide a comprehensive understanding of the research problem.

The quantitative component utilized a descriptive-correlational design to determine the levels of self-regulation, teaching efficacy, and mathematics teaching anxiety and to examine the predictive influence of these variables using multiple regression analysis.

Participants and sampling procedure

The study respondents were all fourth-year mathematics pre-service teachers enrolled in the BSED program during the study, for a total population of 78 students. Given the manageable population size, the researchers employed complete enumeration to ensure full representation of the target population and minimize sampling bias. Thus, all eligible pre-service teachers were included in the quantitative phase.

Self-regulation scale

Self-regulation was measured using an adapted scale based on Barry Zimmerman's Self-Regulated Learning Theory (2000). The instrument assessed four dimensions: planning, monitoring, adjusting, and reflecting. The original version consisted of 24 items; however, minor wording revisions were made to align with the context of mathematics teaching internship experiences. Following expert review, two redundant items were removed,

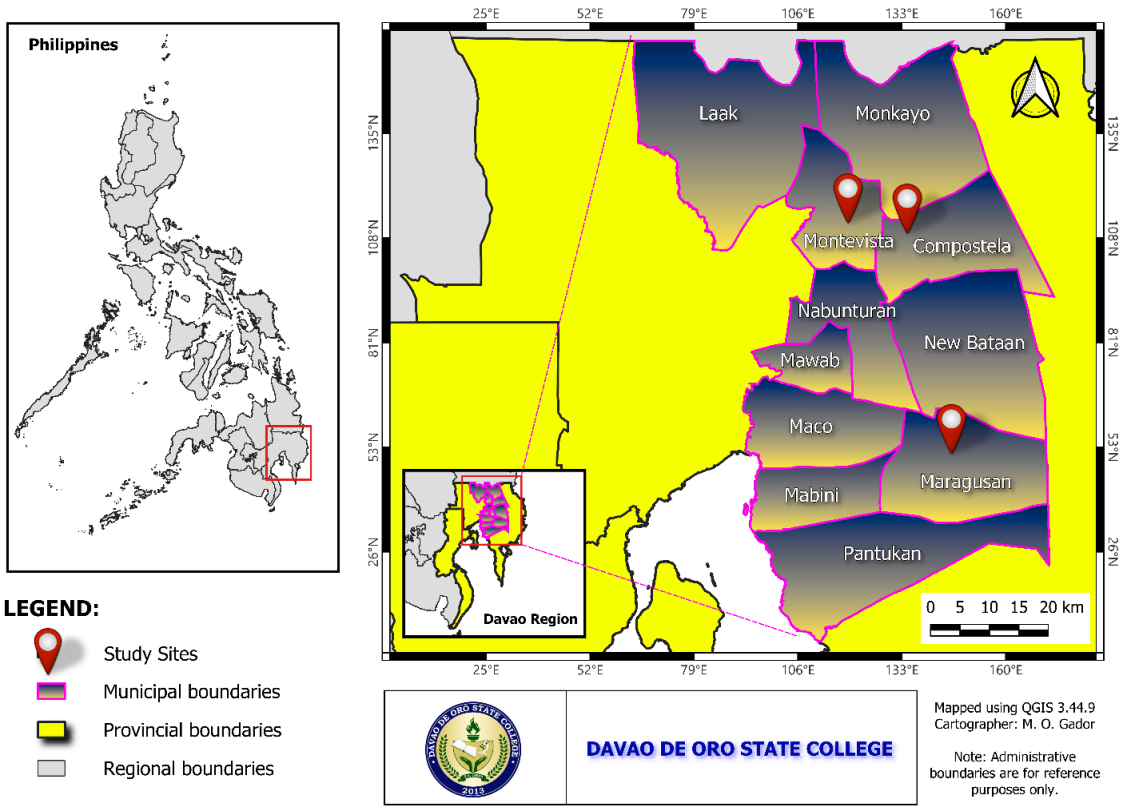


Figure 1. Geographic Location of the Study Site: State College in Davao de Oro, Philippines.

resulting in a final 22-item instrument rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)

Teaching efficacy was measured using an adapted version of the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) developed by Enochs et al. (2000). The instrument measures two domains: Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectancy (MTOE). Minor wording refinements were made to ensure contextual relevance to Filipino pre-service teachers, while the original two-factor structure and response format were retained.

Mathematics teaching anxiety scale

Mathematics teaching anxiety was assessed using an adapted instrument based on Hunt and Sari (2019), which distinguishes between pupil-directed anxiety and self-directed anxiety. The original 20-item instrument underwent contextual wording revisions to suit the local teaching environment. Following expert evaluation, one redundant item was removed, resulting in a final 19-item scale rated on a 5-point Likert format.

Validity and reliability of the instruments

The instruments established content validity through evaluation by three experts in mathematics education and educational psychology. The experts assessed the clarity, relevance, cultural appropriateness, and alignment of the items with the study objectives. The researchers incorporated necessary revisions based on their recommendations.

While no statistical procedures (e.g., factor analysis) were conducted to establish construct validity, the instruments were conceptually grounded in established theoretical frameworks, including Albert Bandura's Social Cognitive Theory (1997) and Barry Zimmerman's Self-Regulated Learning Theory (2000).

A pilot test was conducted among 30 pre-service teachers from a different institution who were not included in the main study to determine the internal consistency and reliability of the research instruments. The Self-Regulation Scale obtained a Cronbach's alpha coefficient of 0.89, indicating high reliability. Similarly, the Teaching Efficacy Scale yielded a Cronbach's alpha of 0.87, while the Mathematics Teaching Anxiety Scale obtained the highest reliability coefficient of 0.91. All reliability coefficients exceeded the acceptable threshold of 0.70, demonstrating that the instruments possessed good internal consistency and were appropriate for use in the study. All coefficients exceeded the acceptable threshold of 0.70, indicating good internal consistency.

Data collection

Before data collection, the college administration approved the study. Respondents were informed of the study's purpose and provided written informed consent. Participation was voluntary, and the researchers strictly maintained confidentiality and anonymity. The researchers administered survey questionnaires in both printed and digital formats over one month.

Data analysis

Quantitative data were encoded and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including mean and standard deviation, were used to determine the levels of self-regulation, teaching efficacy, and mathematics teaching anxiety. Inferential statistical analyses were likewise conducted using Pearson's product-moment correlation coefficient (r) to determine the relationships among the variables and multiple regression analysis to assess the predictive influence of self-regulation and teaching efficacy on mathematics teaching anxiety. Statistical significance was set at $\alpha = 0.05$.

RESULTS

Table 1. The level of self-regulation among mathematics pre-service teachers in terms of planning.

Planning As a pre-service teacher, i…	**Mean**	**SD**	**Descriptive equivalent**
1. make a list of projects that I want to finish	4.35	.64	Very High
2. have a big test coming up, so I develop a study plan.	4.17	.63	High
3. think about all the things I need to get done before I do something fun.	4.45	.68	Very High
4. can typically anticipate how long it will take me to finish my schoolwork.	4.24	.63	Very High
5. have a hard time formulating plans to assist me in achieving my objectives.	1.96	.73	Low
Category mean	3.83	0.39	High

The category mean for planning is 3.83 (SD = 0.39), described as High. Item 5 obtained the lowest mean (M = 1.96), while Item 3 obtained the highest mean (M = 4.45).

Table 2. The level of self-regulation among mathematics pre-service teachers in terms of monitoring.

Monitoring As a pre-service teacher, I…	**Mean**	**SD**	**Descriptive equivalent**
1. Monitor the progress of my projects.	4.38	.59	Very High
2. Know when i'm behind on a project.	4.33	.64	Very High
3. Monitor my advancement toward my objective.	4.36	.58	Very High
4. Am aware of my grades at all	4.33	.68	Very High
5. Make a list of things i need to do every day and keep track of what i accomplish.	4.44	.68	Very High
6. Have a hard time remembering everything i need to do.	1.90	.71	Low
Category mean	3.96	0.37	High

The category mean for monitoring is 3.96 (SD = 0.37), described as High. Item 10 obtained the highest mean (M = 4.44), while Item 11 obtained the lowest mean (M = 1.90).

Table 3. The level of self-regulation among mathematics pre-service teachers in terms of adjusting.

Adjusting As a pre-service teacher, i…	**Mean**	**SD**	**Descriptive equivalent**
1. Make a lot of effort to do my task on time.	4.46	.60	Very High
2. Make decisions that will help me achieve, even if they aren't the most enjoyable at the time.	4.32	.67	Very High
3. Want to take action as soon as i notice something is not working.	4.40	.57	Very High
4. Keep trying as many different possibilities as i can to achieve.	4.41	.57	Very High
5. Find it difficult to stay focused when it comes to projects that take a long time to accomplish.	1.91	.82	Low
6. Tend to give up when i fall behind on my work.	1.82	.73	Low
Category mean	3.56	0.31	High

The category mean for adjusting is 3.56 (SD = 0.31), described as High. Items 16 and 17 obtained the lowest means (M = 1.91 and 1.82, respectively).

Table 4. The level of self-regulation among mathematics pre-service teachers in terms of reflecting.

Reflecting As a pre-service teacher, I…	**Mean**	**SD**	**Descriptive equivalent**
1. Consider how well i'm doing on my homework.	4.31	.57	Very High
2. Complete all of my tasks on schedule, i feel accomplished.	4.23	.62	Very High
3. Create new goals, i consider how well i've done previously.	4.28	.64	Very High
4. Attempt to learn from my mistakes when i fail at something.	4.28	.64	Very High
5. Repeatedly make the same mistake.	1.97	.76	Low
Category mean	3.82	0.34	High

The category mean for reflecting is 3.82 (SD = 0.34), described as High. Item 22 obtained the lowest mean (M = 1.97).

Table 5. The level of teaching efficacy among mathematics pre-service teachers in terms of personal mathematics teaching efficacy.

Personal Mathematics Teaching Efficacy (PMTE) As a pre-service teacher, I…	**Mean**	**SD**	**Descriptive equivalent**
1. Will continually find better ways to teach mathematics.	4.44	.62	Very High
2. Won't be able to teach mathematics as effectively as most other subjects, no matter how hard i try.	1.96	.73	Low
3. Know how to teach mathematics concepts effectively.	4.29	.72	Very High
4. Will not be very effective in monitoring mathematics activities.	1.90	.71	Low
5. Will generally teach mathematics ineffectively.	1.86	.73	Low
6. Understand mathematics concepts well enough to be effective in teaching elementary mathematics.	4.17	.67	High
7. Will find it difficult to use manipulatives to explain to students why mathematics works.	1.97	.74	Low
8. Will typically be able to answer students' questions.	4.21	.63	Very High
9. Wonder if i will have the necessary skills to teach mathematics.	3.99	.69	High
10. Would choose not to invite the principal to evaluate my mathematics teaching.	1.85	.70	Low
11. Will usually be at a loss as to how to help the student understand it better.	2.04	.71	Low
12. Will usually welcome student questions.	4.38	.61	Very High
13. Do not know what to do to turn students on to mathematics.	1.90	.73	Low
Category mean	3.01	0.18	Moderate

The category mean for PMTE is 3.01 (SD = 0.18), described as Moderate. Items 5 and 10 obtained the lowest means (M = 1.86 and 1.85, respectively).

Table 6. The level of teaching efficacy among mathematics pre-service teachers in terms of mathematics teaching outcome expectancy.

Mathematics Teaching Outcome Expectancy (MTOE) **As a pre-service teacher, I…**	**Mean**	**SD**	**Descriptive equivalent**
1. noticed that when a student improves in mathematics, it's often due to the teacher putting in a bit more effort.	4.28	.68	Very High
2. observe that when students' mathematics grades improve, it's often because the teacher has found a more effective teaching approach.	4.35	.64	Very High
3. believe that if students are underachieving in mathematics, it's likely due to ineffective teaching methods.	4.23	.68	Very High
4. believe that a student's inadequate mathematics background can be overcome with effective teaching.	4.33	.68	Very High
5. observe that when a low-achieving child progresses in mathematics, it's often because the teacher has provided extra attention.	4.21	.69	Very High
6. believe that the teacher is generally responsible for the achievement of students in mathematics.	4.29	.61	Very High
7. believe that students' achievement in mathematics is directly connected to the effectiveness of their teacher's instruction.	4.40	.65	Very High
8. believe that if parents notice their child showing more interest in mathematics at school, it is likely due to the performance of the child's teacher.	4.18	.72	High
Category mean	4.28	0.52	Very High

The category mean for MTOE is 4.28 (SD = 0.52), described as Very High. Item 20 obtained the highest mean (M = 4.40).

Table 7. The level of Mathematics teaching anxiety among Mathematics Pre-service teachers in terms of pupil/student-directed.

Pupil/Student- directed	Mean	SD	Descriptive equivalent
1. The thought of not being able to motivate students to learn math bothers me.	4.32	.63	Very High
2. The thought that students find math too abstract concerns me.	4.14	.72	High
3. The thought that students/pupils will not meet the curriculum/school targets in math worries me.	4.18	.66	High
4. The thought that students/pupils will not pay attention to what I am teaching in Math class worries me.	4.23	.60	Very High
5. I worry that students/pupils in my math class will fail their assessments.	4.36	.66	Very High
6. Differences in students'/pupils' prior knowledge worry me when preparing for math lessons.	4.27	.62	Very High
7. I worry that students/pupils will answer math questions incorrectly.	4.26	.63	Very High
Category mean	4.25	0.51	Very High

The category mean for Pupil/Student-directed is 4.25 (SD = 0.51), described as Very High. Item 5 obtained the highest mean (M = 4.36).

Table 8. The level of Mathematics teaching anxiety among mathematics Pre-service teachers in terms of self-directed.

Self-directed	Mean	SD	Descriptive equivalent
1. At the end of my math class, I erase the content on the board so that colleagues can't see.	4.05	.70	High
2. I wait for breaks impatiently when I am in math classes.	4.10	.73	High
3. I am afraid to go beyond the content of math textbooks.	4.05	.77	High
4. I avoid talking about mathematics teaching with other teachers outside the classroom.	3.83	1.03	High
5. I avoid classroom discussion in case students pose difficult math questions.	3.76	1.11	High
6. I get uneasy knowing that the next lesson is mathematics.	3.81	1.11	High
7. I feel nervous when a pre-service/trainee teacher observes my math teaching.	4.01	.97	High
8. I feel uncomfortable when one of my colleagues comes to my classroom during a math lesson.	3.87	1.11	High
9. I worry that I won't be able to answer a question while teaching a math class.	4.15	.69	High
10. Thinking about how to make use of tools/materials that I don't know how to use in the math classroom makes me feel anxious.	4.10	.68	High
12. The thought of using concrete tools (e.g., geometry boards, pattern blocks, tangrams, and fraction bars) in math classes worries me.	4.06	.65	High
13. I feel uneasy when students/pupils don't understand mathematical concepts, and I have to find/think about alternative methods or strategies to teach them.	4.12	.74	High
Category mean	3.99	0.64	High

The category mean for self-directed anxiety is 3.99 (SD = 0.64), described as High.

Table 9. Relationship between self-regulation and teaching efficacy towards mathematics teaching anxiety.

Independent Variable	MTA		
	r-value	*p*-value	Remarks
Self-regulation	0.40	0.000	Significant
Teaching efficacy	0.50	0.000	Significant

Correlation is significant at the 0.05 level (2-tailed)

Correlation analysis revealed that the positively and negatively worded items in the instruments were appropriately coded before data analysis. For positively worded items, the original Likert-scale responses were retained, whereas negatively worded items were reverse-coded so that all items were oriented in the same conceptual direction. For example, on a five-point Likert scale, responses of 1, 2, 3, 4, and 5 for a negatively worded item were recorded as 5, 4, 3, 2, and 1, respectively.

After reversing the negatively worded items, the item scores were combined to obtain the respective composite scores for self-regulation, teaching efficacy, and mathematics teaching anxiety. We then used these composite scores in the correlation

and regression analyses. Thus, the positive correlations reported between self-regulation and mathematics teaching anxiety (r = .40, p < .001) and between teaching efficacy and mathematics teaching anxiety (r = .50, p < .001) reflect the relationships based on the appropriately oriented composite scores.

The results indicate that, when self-regulation and teaching efficacy were examined simultaneously in the multiple regression model, only teaching efficacy significantly predicted mathematics teaching anxiety. Although self-regulation was significantly associated with mathematics teaching anxiety at the bivariate level, it did not make a statistically significant unique contribution to the regression model (p = .22).

Table 10. Multiple regression analysis predicting mathematics teaching anxiety.

Predictor	B	SE	β	*t*	*p*
Constant	0.38	0.75	—	0.51	.615
Self-Regulation	0.27	0.22	.15	1.23	.222
Teaching Efficacy	0.74	0.23	.41	3.31	.001
R^2 = .263	F = 13.41		p = .001		

Regression analysis showed that teaching efficacy significantly predicted mathematics teaching anxiety (B = .74, β = .41, p = .001), while self-regulation did not significantly predict mathematics teaching anxiety (p = .22). The model explained 26.3% of the variance in anxiety (R^2 = .26). The computed Cohen's f^2 of 0.36 indicates a large effect size, suggesting that the model has substantial explanatory power.

DISCUSSION

1. Levels of self-regulation, teaching efficacy, and mathematics teaching anxiety

The findings revealed that mathematics pre-service teachers demonstrated high levels of self-regulation across planning, monitoring, adjusting, and reflecting dimensions. These results indicate strong metacognitive awareness and adaptive learning behaviours, widely recognized as essential components of professional teacher development (Zimmerman, 2002; Panadero, 2017). International research emphasizes that reflective practice and continuous monitoring help pre-service teachers develop instructional competence and professional autonomy (Kabilan and Khan, 2019; Layden et al., 2022). Within the Philippine context, structured internship programs, reflective journals, and demonstration teaching requirements embedded in teacher education curricula may explain the elevated self-regulation levels observed.

In terms of teaching efficacy, Mathematics Teaching Outcome Expectancy (MTOE) was very high, while Personal Mathematics Teaching Efficacy (PMTE) was moderate. This pattern mirrors findings in international teacher education research where pre-service teachers often express strong beliefs in the power of effective instruction while simultaneously doubting their own instructional capability (Tschannen-Moran and Hoy, 2001; Klassen and Chiu, 2010). Gorospe (2022) reported a similar trend among Filipino pre-service teachers, highlighting a gap between belief in teaching as a profession and confidence in personal teaching performance.

Mathematics teaching anxiety was found to be high in both pupil-directed and self-directed domains. In contrast, several Western studies report only moderate levels of mathematics teaching anxiety among pre-service teachers (e.g., Patkin and Greenstein, 2020). In the Philippines, the intensive nature of supervised internship and demonstration teaching may contribute to heightened emotional pressure, consistent withfindings by Pentang et al. (2023) and Tongol (2024).

This suggests that pre-service teachers who strongly believe teaching influences student achievement may also experience heightened anxiety from the pressure to meet expectations. Self-regulation, while correlated with anxiety, does not directly predict it.

2. Relationship among self-regulation, teaching efficacy, and Mathematics teaching anxiety

The findings showed significant positive relationships between self-regulation and mathematics teaching anxiety (r = .40, p < .001) and between teaching efficacy and mathematics teaching anxiety (r = .50, p < .001). This suggests that participants with higher self-regulation and teaching efficacy also reported higher mathematics teaching anxiety. This finding is consistent with Gorospe (2022), who found a significant relationship between teaching self-efficacy and teaching anxiety among pre-service teachers. This suggests that confidence in teaching ability may coexist with concerns about teaching performance and classroom demands. Similarly, the positive relationship between self-regulation and anxiety may indicate that individuals who actively monitor and regulate their thoughts and behaviours may also be more aware of the challenges and demands associated with teaching mathematics. Overall, the findings suggest that self-regulation and teaching efficacy may have complex relationships with mathematics teaching anxiety that depend on preservice teachers' teaching context and experiences. Although many studies report negative associations between efficacy and anxiety (Bosica, 2022), emerging literature suggests that this relationship is not always linear and may depend on how anxiety functions in professional contexts. Recent psychological and educational research distinguishes between maladaptive anxiety, which inhibits performance, and adaptive (facilitative) anxiety, which heightens alertness, preparation, and task engagement (Putwain, 2007; Jerrim et al., 2020). In this view, moderate levels of anxiety may reflect professional concern and responsibility rather than fear or incompetence. As pre-service teachers develop stronger self-regulation and teaching efficacy, they may also become more aware of the instructional demands placed upon them, increasing performance-related tension.

Tongol (2024) emphasized that Filipino pre-service teachers who demonstrate strong professional commitment often experience heightened anxiety due to fear of not meeting supervisory and institutional expectations. Similarly, Pentang et al. (2023) noted that prior negative experiences with mathematics may interact with efficacy beliefs, producing emotional tension during teaching practice. Thus, the positive correlations observed in this study may represent adaptive performance anxiety associated with heightened professional awareness rather than dysfunctional fear.

3. Influence of self-regulation and teaching efficacy on mathematics teaching anxiety

Regression analysis revealed that teaching efficacy significantly predicts mathematics teaching anxiety, whereas self-regulation does not. This finding suggests that beliefs about instructional capability play a more direct role in shaping emotional responses than metacognitive regulation skills. Consistent with Gorospe (2022), teaching self-efficacy significantly influences anxiety levels among Filipino pre-service teachers. When individuals strongly believe that effective teaching determines student outcomes, they may experience heightened pressure to meet those expectations. In the Philippine internship setting, where demonstration teaching and evaluations are central to training, these beliefs may intensify emotional strain. Although self-regulation was high, it did not significantly predict anxiety. This suggests that cognitive strategies such as planning and monitoring alone are insufficient to buffer emotional stress during teaching practice. Emotional readiness, mentoring support, and structured feedback mechanisms may therefore be more critical in reducing mathematics teaching anxiety.

Overall, the findings highlight the need for Philippine teacher education programs to strengthen personal mathematics teaching efficacy through guided practice, mentoring, and supportive supervision while also integrating emotional coping strategies into professional preparation.

CONCLUSION

This study established that pre-service mathematics teachers demonstrate high levels of self-regulation and strong beliefs in the impact of teaching on student learning. Yet, they simultaneously experience high levels of mathematics teaching anxiety. The findings confirm that the presence of competence-related attributes does not automatically reduce anxiety. Instead, heightened awareness of instructional responsibility and expectations may increase teaching anxiety, particularly when pre-service teachers doubt their ability to meet these expectations.

In the Philippine educational landscape, where students continue to perform below global standards in international assessments such as PISA, confident and emotionally prepared mathematics teachers are critical. The results suggest that i mproving mathematics instruction requires not only stronger content knowledge and pedagogy but also greater attention to future teachers' emotional and psychological readiness. Pre-service teachers strongly believe that effective teaching determines student success, and this belief may unintentionally put pressure on them and lead to anxiety.

These findings have direct implications for teacher education institutions and policymakers. Teacher preparation programs should incorporate structured interventions such as mentoring systems, guided teaching simulations, explicit training in using manipulatives and instructional tools, reflective practices, and stress-management strategies. Embedding emotional regulation and coping mechanisms in the curriculum can help pre-service teachers channel their strong sense of responsibility into productive teaching confidence rather than anxiety.

The study also indicates that self-regulation and teaching efficacy alone cannot fully explain mathematics teaching anxiety. Other factors such as content mastery, prior mathematics experiences, personality traits, mentoring exposure, and technological competence may also contribute to anxiety levels and should be explored further.

Future research may extend this study by using mixed-methods designs to explain better how emotional, cognitive, and contextual factors interact in shaping teaching anxiety. Longitudinal studies may also be conducted to determine how teaching anxiety changes from pre-service training to actual classroom practice. Future investigations may also examine the role of AI integration, mentoring programs, and practical teaching exposure in reducing mathematics teaching anxiety among pre-service teachers.

Preparing effective mathematics teachers for the Philippine education system therefore requires a holistic approach that strengthens instructional competence, emotional resilience, and adaptive use of emerging technologies to ensure both teaching effectiveness and teacher well-being.

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AUTHOR CONTRIBUTIONS

The first author led the study's conceptualization, research design, data collection, data analysis, and initial drafting. The second author (initials of co-author) contributed to reviewing, validating, and revising the manuscript to ensure accuracy, clarity, and coherence. Both authors conducted the study collaboratively and finalized the manuscript, with the first author leading the core research processes and the second author providing critical evaluation and refinement.

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DECLARATIONS

Informed consent statement

The study followed established ethical principles for research involving human participants. Before data collection, the college administration approved the study. Participants were informed of the study's purpose and procedures, and the researchers obtained written informed consent. Participation was voluntary, and participants were informed of their right to withdraw without consequence. The researchers maintained confidentiality and anonymity by coding data and restricting access to the collected data. The researchers took appropriate measures to protect participants' privacy, dignity, and well-being throughout the study.

Conflict of interest

The authors declare no conflicts of interest that could have influenced this study's conduct, analysis, interpretation, or reporting.

AI Disclosure

Artificial intelligence (AI) tools were used only to assist with language editing, grammar checking, and improvement of clarity during manuscript preparation and revision. The authors reviewed and verified all AI-assisted suggestions and remain fully responsible for the manuscript's accuracy, originality, interpretation, and final content. AI tools were not used to generate, fabricate, or manipulate research data, results, or references.

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