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Predicting mathematics teaching anxiety from mathematics performance and mathematics anxiety

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ABSTRACT

This study aims to identify the predictors of mathematics teaching anxiety among Filipino preservice elementary teachers. This research utilized a descriptive-correlational research design. Data were obtained through a descriptive survey from 145 students, selected using stratified random sampling from a state university in Central Luzon, Philippines. The study administered the adopted mathematics anxiety scale-UK, the mathematics teaching anxiety scale, and a mathematics test. According to our findings, mathematics performance and mathematics teaching anxiety were negatively correlated. On the other hand, a positive correlation emerged between mathematics anxiety and mathematics teaching anxiety. Furthermore, this study employed stepwise regression analysis. Our results showed that "mathematics evaluation anxiety", a parameter of mathematics anxiety significantly predicts respondents' mathematics teaching anxiety. Examining the predictors of mathematics teaching anxiety is crucial for improving teacher preparation, enhancing teaching quality, and creating a positive learning environment.

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1. INTRODUCTION

Mathematics teachers play a critical role in assisting students with their learning and understanding of mathematics. This learning process is negatively influenced by teachers experiencing mathematics teaching anxiety. Teachers experiencing this anxiety could experience difficulty in teaching effectively which could hinder students' learning of mathematics concepts. To address this ongoing concern, this study investigated how mathematics teaching anxiety of Filipino preservice elementary teachers is influenced by their mathematics anxiety and mathematics performance.

Mathematics teaching anxiety is defined as anxiety concerning teaching mathematics, associated with real or perceived deficits in mathematics content, mathematics teaching skills, and memories of past occurrences of mathematics failure or anxiety [1]. When teachers experience mathematics teaching anxiety, they may exhibit reactions such as tension, increase in heart rate, difficulty concentrating, easy distraction, inattentiveness to students, vibrating hands, cold sweat, qualm, or negative self-talk [1]–[3]. Educators experiencing this form of anxiety may harbor self-doubt regarding their understanding of mathematical concepts, leading to concerns about their ability to present information accurately and comprehensibly. Usually experienced by preservice teachers and novice teachers, teaching anxiety may be due to feelings of inadequacy in mathematical content knowledge, inadequacy in knowledge of mathematics teaching, inadequacy in skills such as mastery of using technology [3], lack of mastery of teaching materials, confusion

in applying learning strategies, difficulty of managing classes [2], experiencing mathematics anxiety, low levels of self-confidence, and unsupportive learning infrastructure [4]. Furthermore, the fear of making errors or encountering challenging questions can amplify this anxiety. These feelings and behaviors hurt the overall experience of teaching mathematics and subsequently hinder students' learning of mathematics.

Several works have studied mathematics teaching anxiety and its relationship to other factors. These factors include primary school teachers' mathematical thinking [5], [6], mathematics school teachers' teaching self-efficacy beliefs and motivation toward teaching [7], and mathematics teachers' attitudes toward the teaching profession [8]. Others also investigated the relationship between mathematics teaching anxiety, and preservice and in-service mathematics teachers' pedagogical content knowledge [9], [10], preservice mathematics teachers' technological pedagogical and content knowledge [11]–[13], perception regarding technology and their computer literacy [14], and mathematics self-efficacy [15]. Researchers also examined the relationship between mathematics teaching anxiety and preservice preschool teachers' mathematical development beliefs [16], preservice elementary teachers' mathematical beliefs [17], [18], mathematical values [19], and preservice and in-service teachers' mathematics-related beliefs about teaching and learning mathematics [20]–[22]. Studies also showed contrasting results between the relationship between mathematics teaching anxiety and gender [23], [24]. A content analysis of the studies on mathematics teaching anxiety in [25] was conducted where differences and similarities between the studies were determined by their purposes and results.

Some studies have explored the relationship between mathematics anxiety and mathematics teaching anxiety [22], [26]–[28]. Mathematics anxiety can be described as the anxiety when asked to learn or perform mathematics [29]. Mathematics anxiety has been extensively studied, see [30] and references therein. Brown *et al.* [31], investigated how students' mathematics anxiety leads to mathematics teaching anxiety. They have established that mathematics anxiety is not always linked to mathematics teaching anxiety. Researchers also concluded that teachers' mathematics teaching anxiety was positively associated with their students' mathematics anxiety with low socioeconomic status [28], [32]. Olson and Stoehr [29], found that individuals who experience mathematics anxiety as students may bring that history of anxiety to their teaching. Despite the significance of the relationship between mathematics anxiety and mathematics teaching anxiety, research investigating this association and its impact on preservice Filipino teachers' instruction remains limited.

While research has determined that preservice elementary teachers' high level of anxiety resides in the constructs of content knowledge and conceptual understanding [33], they have not explicitly addressed the relationship between preservice teachers' mathematics teaching anxiety and mathematics performance. Research findings identified teachers' qualifications as a significant factor influencing students' academic performance [34]. Effective mathematics instruction requires educators to possess a deep understanding of mathematical concepts as well as the confidence and ability to transfer this knowledge to their students.

In the Philippines, most of the students' mathematics performance is in a "poor state", where 70.59% of the respondents demonstrated below average grades in mathematics [35]. As indicated in the 2022 Programme for International Student Assessment (PISA) International Report, students in the Philippines exhibited low proficiency in mathematics [36]. This alarming outcome provides a sufficient reason to pay close attention to the concerns experienced by educators and prospective educators of the country. This paper explored the following problems: i) determine the level of mathematics teaching anxiety, mathematics anxiety, and mathematics performance of Filipino preservice elementary school teachers; ii) determine if there is a significant relationship between mathematics performance and mathematics teaching anxiety of the respondents; iii) determine if there is a significant relationship between mathematics anxiety and mathematics teaching anxiety of the respondents; and iv) find the best predictors of mathematics teaching anxiety in respondents' mathematics anxiety. Examining the predictors of mathematics teaching anxiety is crucial for improving teacher preparation, enhancing teaching quality, and creating a positive learning environment.

2. RESEARCH METHOD

A descriptive-correlational research design was used in the study. For a detailed introduction to descriptive research design and correlational research design, one may refer to [37], [38] respectively. The descriptive design was utilized to provide descriptions of the respondents' mathematics performance, mathematics anxiety, and mathematics teaching anxiety. Similarly, a correlational design was employed to ascertain how mathematics performance, and different aspects of mathematics anxiety (mathematics evaluation anxiety, social mathematics anxiety, and mathematics observation anxiety) relate to mathematics teaching anxiety.

The respondents of the study were 145 preservice elementary teachers, taking the degree bachelor of elementary education in a state university at Central Luzon, Philippines. In this study, a stratified random sampling approach was employed. This sampling approach involves dividing the population into more compact

strata or subgroups, which can be allocated by the common characteristics exhibited by the respondents. This sampling technique was chosen as it aligns with the diverse year levels of the respondents, effectively serving as distinct strata. The sample size agrees with the minimum sample size of 123 respondents suggested by G*Power software for linear multiple regression (fixed model, R^2 deviation from zero) with effect size f^2=0.15, α=0.05, power level (1-β) of 0.90, and 6 predictors. One may refer to [39] for the manual of G*Power.

The instrument used in this study was composed of three parts: a 40-item mathematics test, the mathematics anxiety scale-UK, and the mathematics teaching anxiety scale. The first part was a 40-item mathematics aptitude test consisting of elementary mathematics problems to determine the mathematics performance of the respondents [40]. The questions were about the basic concepts of whole numbers up to 10000, fractions, rational numbers, measurement, pre-algebra concepts, simple geometric figures, data representation and analysis, and application of simple probability.

The second part of the instrument, the mathematics anxiety scale-UK [41] was used to measure the elementary preservice teachers' mathematics anxiety. It was based on the mathematics anxiety rating scale with 23 items on a five-point Likert scale anchored at points with the statement: not at all, slightly, a fair amount, much, and very much. Higher scores reflect a higher level of mathematics anxiety. The Cronbach's Alpha for the overall scale was excellent (α=0.96), as well as its parameters: mathematics evaluation anxiety (α=0.92), social mathematics anxiety (α=0.85), and mathematics observation anxiety (α=0.89). Cronbach's Alpha greater than 0.70 indicates high reliability.

The last part of the instrument, the mathematics teaching anxiety scale adopted from [42] was used to assess preservice teachers' mathematics teaching anxiety. It consists of 24 items on a four-point Likert-type scale. The respondents were asked to indicate the extent to which they felt mathematics teaching anxiety on a four-point Likert scale anchored at points with the statements: strongly disagree, disagree, agree, and strongly agree. Before the analysis of data, positive statements are reverse coded. Higher scores indicate a higher level of mathematics teaching anxiety. The instrument's high reliability was demonstrated by a Cronbach's Alpha coefficient of 0.884.

This study used descriptive statistics such as means, percentages, and standard deviations to describe the respondents' mathematics performance, mathematics anxiety, and mathematics teaching anxiety. The study employed inferential statistics, specifically bivariate correlational analysis using Pearson's coefficient *r* to explore if there is a significant relationship between mathematics performance and mathematics teaching anxiety among the respondents. Similarly, to test if there is a significant relationship between mathematics anxiety and mathematics teaching anxiety among the respondents, the study employed bivariate correlational analysis using Pearson's coefficient *r*. Finally, to investigate the predictors of mathematics teaching anxiety of the respondents, stepwise regression analysis was utilized. Before applying stepwise regression analysis, the following assumptions are tested: variables are measured at the continuous level, linear relationship between variables, no significant outliers using Cook's distance statistic for each respondent's data, independence of observations of the data using Durbin-Watson statistic, homoscedasticity of the data, and regression line is approximately normally distributed.

3. RESULTS AND DISCUSSION

We found that preservice elementary teachers' mathematics performance negatively correlates with mathematics teaching anxiety. Furthermore, there is a significant positive correlation between preservice elementary teachers' mathematics anxiety and mathematics teaching anxiety. Details of these results are presented and discussed in the following subsections. We first described the mathematics performance, mathematics anxiety, and mathematics teaching anxiety of the preservice elementary teachers. Then, we discussed the relationships of these variables.

3.1. Respondents' mathematics performance

Out of the 40-item mathematics test, the respondents' mathematics performance had a mean ($\bar{x}$) of 20.34, with a standard deviation (σ) of 5.44. The respondents' mathematics performance was divided into three levels: below average, average, and above average. The majority of respondents (91 or 62.76%) demonstrated average mathematics performance, with scores ranging from 14.90 to 25.78. Additionally, 31 (21.38%) respondents performed above average in mathematics, scoring above 25.78. A total of 23 (15.86%) respondents fell into the below-average category, indicating that their mathematics ability was lower than the sample's overall average. This result revealed that a score of 14.90 (37.25% of 40) is considered as an average mathematics performance of Filipino preservice elementary teachers. This result aligns with the findings in [43], which revealed that a significant proportion of students enrolled in Philippine state universities exhibit average performance or achievement in mathematics. This result may pose a concern because insufficient or average levels of mathematics performance doubt the respondents' content knowledge or mastery of the content.

3.2. Respondents' mathematics anxiety

The data indicated a moderate level of mathematics anxiety among the preservice elementary teachers with $\bar{x}$=3.04 and σ=0.74 shown in Table 1. The results aligned with the study in [44] which suggested that students have moderate level of mathematics anxiety. However, the outcomes of the study disagreed with the conclusion drawn in [45], which suggested that preservice elementary school teachers generally exhibit low level of mathematics anxiety based on their scores. Contradicting results may be because the respondents of the two studies have different learning environments which may be a contributing factor to their levels of mathematics anxiety. It's important to note that this work and the study in [44] were conducted in the Philippines, a developing country whereas the study in [45] was carried out in Turkey, a developed country.

The mean and standard deviation for each parameter of mathematics anxiety were also calculated. Scores that fell below the mean indicated that the respondents had a low level of anxiety in the parameter. Conversely, scores that exceeded the mean indicated that the respondents had a high level of anxiety in the parameter. The respondents exhibited moderate levels of mathematics evaluation anxiety ($\bar{x}$=3.34, σ=0.76). In contrast, they exhibited mild levels of social mathematics anxiety ($\bar{x}$=2.81, σ=0.92) and mathematics observation anxiety $\bar{x}$=2.91, σ=0.97).

The respondents experienced mathematics evaluation anxiety where most of them (114 or 78.6%) felt severe anxiousness when taking mathematics tests, especially when it's a surprise test. The majority of them (86 or 59.3%) felt mild level of evaluation anxiety when they were being watched to solve or answer basic mathematics problems such as taking the product of 12×23. This suggested that the idea of a surprise mathematics test significantly increased anxiety levels for most respondents. On the other hand, majority of them were able to answer basic mathematics problems such as multiplying two-digit numbers but were not comfortable being watched by doing mathematics tasks.

The respondents also experienced social mathematics anxiety because they were likely not confident enough in dealing with mathematical problems related to time or money. Fewer than half of them (69 or 47.6%) felt mild level of anxiousness in applying numeracy in daily life activities. For instance, when they planned to come to class on time, they failed in determining enough time to set off to the university. On the other hand, majority of them (98 or 67.6%) felt the least anxious when they were "being asked to add up the number of people in a room".

Finally, the respondents also exhibited mathematics observation anxiety when they were physically present in a mathematics class, perhaps due to the environment or the subject matter being taught. The majority of the respondents (84 or 57.9%) felt mild level of anxiousness when reading the word algebra. On the other hand, majority of the respondents (76 or 52.4%) felt moderate level of anxiousness when sitting in a mathematics class.

Table 1. Respondents' mathematics anxiety

Parameters of mathematics anxiety	Mean ($\bar{x}$)	SD (σ)	Level of anxiety
Mathematics evaluation anxiety	3.34	0.76	Moderate
Social mathematics anxiety	2.81	0.92	Mild
Mathematics observation anxiety	2.91	0.97	Mild
Overall mathematics anxiety	3.04	0.74	Moderate

Legend: low (1.00-2.00), mild (2.01-3.00), moderate (3.01-4.00), and severe (4.01-5.00).

3.3. Respondents' mathematics teaching anxiety

The respondents' scores on the mathematics teaching anxiety scale determined their level of mathematics teaching anxiety. In Table 2, it was found that respondents displayed a moderate level of mathematics teaching anxiety ($\bar{x}$=2.63, σ=0.42). This result disagreed with [42], where elementary teachers showed a mild level of mathematic teaching anxiety, and with [46], where preservice teachers demonstrated a low level of mathematics teaching anxiety. This may be due to external factors such as changes in societal norms, economic conditions, or technological advancements.

The respondents exhibited moderate level of behavioral anxiety in teaching mathematics ($\bar{x}$=2.69, σ=0.53). The majority of the respondents (100 or 68.97%) felt mild level of anxiety in the statement *"Having to work with fractions causes me nausea"*. On the other hand, most of the respondents (115 or 79.31%) felt moderate level of anxiety in the statement *"I am trembling every time I am teaching mathematics concepts that is new to me"*. These findings shed light on the specific triggers of anxiety in mathematics teaching. Teaching unfamiliar or complex concepts such as topics involving fractions can be anxiety-inducing, as teachers may fear not being able to effectively convey the material to their students. These results suggest that teacher training, content enrichment and professional development in these specific areas may be particularly valuable to help educators manage and reduce their anxiety when teaching mathematics.

Table 2. Respondents' mathematics teaching anxiety

Parameters of mathematics anxiety	Mean ($\bar{x}$)	SD (σ)	Level of anxiety
Behavioral mathematics teaching anxiety	2.69	0.53	Moderate
Psychological mathematics teaching anxiety	2.72	0.34	Moderate
Emotional mathematics teaching anxiety	2.56	0.51	Moderate
Overall mathematics teaching anxiety	2.63	0.42	Moderate

Legend: low (1.00-1.75), mild (1.76-2.50), moderate (2.51-3.25), and severe (3.26-4.00).

Respondents also experienced psychological anxiety in teaching mathematics ($\bar{x}$=2.72, σ=0.34). The majority of the respondents (101 or 69.66%) felt a mild level of anxiety in the statement *"I am losing my attention when teaching mathematics problems related to real-life situations"*. Consequently, most of the respondents (120 or 82.76%) felt moderate anxiousness in the statement *"I am repeatedly reading and memorizing the new lesson to be discussed the following day"*. These findings indicated that the anxiety from the pressure to deliver information effectively and accurately in the classroom, which is a common concern among educators, tends to be associated with memorizing new lessons to be taught rather than understanding the concept. Hence, the results suggested that teaching real-life mathematical problems may require a heightened level of focus and attention, as it often involves relating abstract mathematical concepts to practical, everyday situations.

Finally, respondents showed moderate level of emotional anxiety in teaching mathematics ($\bar{x}$=2.56, σ=0.51). Majority of the respondents (105 or 72.41%) felt mild level of anxiety in statement *"I am not excited to learn new concepts in mathematics"*. On the other hand, the majority of the respondents (105 or 72.41%), felt moderate level of anxiety in the statement *"I become anxious when I have to compute percentages, fractions, and decimals"*. These results suggested that emotional anxiety plays a significant role in the experiences of mathematics teachers. The mild anxiety related to the lack of excitement for learning new mathematical concepts may reflect the need for teachers to continuously update their knowledge and adapt to new teaching materials. On the other hand, the moderate anxiety associated with computations involving percentages, fractions, and decimals highlights the apprehension that can arise when dealing with mathematical concepts that are often perceived as intricate or error-prone.

3.4. Relationship between mathematics performance and mathematics teaching anxiety

In this study, we found that preservice elementary teachers' mathematics performance negatively correlates (r=-0.219, p=0.008) with mathematics teaching anxiety shown in Table 3. The negative correlation indicated an inverse relationship between mathematics performance and mathematics teaching anxiety among the respondents. This means that individuals with higher levels of mathematics performance tend to have lower levels of mathematics teaching anxiety. Conversely, those with lower mathematics performance exhibit higher levels of mathematics teaching anxiety. The results of this study aligned with [47], which claimed that as the teachers' mathematical knowledge increases, their levels of mathematics teaching anxiety decrease. This relationship suggested that the individual mathematics performance of preservice elementary teachers can influence their level of anxiety when teaching mathematics. This result might be because those with higher level of mathematics performance have more confidence to teach mathematics, boosted by their sufficient content knowledge and mathematical skills. On the other hand, low-performing individuals tend to have higher levels of mathematics teaching anxiety due to their lack of content knowledge and experience needed to teach the subject effectively and with confidence.

Table 3. Relationship between mathematics performance and mathematics teaching anxiety

Correlating variables	*r*	*p*
Mathematics performance	-0.219**	0.008
Mathematics teaching anxiety		

**Correlation is significant at the 0.01 level (2-tailed).

3.5. Relationship between mathematics anxiety and mathematics teaching anxiety

This study found that there were significant positive correlations between all parameters of mathematics anxiety and the parameters of mathematics teaching anxiety except social mathematics anxiety and emotional anxiety in teaching mathematics shown in Table 4. There was a moderate positive correlation between mathematics evaluation anxiety and behavioral anxiety in teaching mathematics (r=0.479, p=0.000), indicating that individuals who experience higher level of mathematics evaluation anxiety are also likely to exhibit higher level of behavioral mathematics teaching anxiety. The fear of being evaluated negatively in mathematics could lead to a lack of confidence when teaching mathematics. Likewise, social mathematics anxiety exhibited a weak positive correlation with behavioral anxiety in teaching mathematics (r=0.261,

p=0.002), indicating that individuals who experienced higher level of social mathematics anxiety also tend to exhibit higher level of behavioral anxiety in teaching mathematics. The finding indicated that social anxiety in mathematics might make teachers feel self-conscious or anxious about how they are perceived by students or peers during mathematics instruction. The fear of making mistakes in front of others could translate into anxiety when teaching mathematics. Furthermore, mathematics observation anxiety demonstrated a moderate positive correlation with behavioral anxiety in teaching mathematics (*r*=0.405, *p*=0.000). This result suggested that individuals who experience higher level of mathematics observation anxiety are more likely to exhibit higher level of behavioral anxiety in teaching mathematics. In the same way, overall mathematics anxiety showed a moderate positive correlation with behavioral anxiety in teaching mathematics (*r*=0.444, *p*=0.000), which indicates that individuals who experience higher level of mathematics anxiety are also likely to exhibit higher level of behavioral anxiety. It seemed that the presence of observers can create performance pressure for preservice elementary teachers, leading to behavioral anxiety. Fear of scrutiny and judgment during classroom observation may heighten anxiety during the instruction process.

A moderately positive correlation emerged between mathematics evaluation anxiety and psychological anxiety in teaching mathematics (*r*=0.415, *p*=0.000), which signifies that individuals who experience higher level of mathematics evaluation anxiety are also likely to exhibit higher level of psychological anxiety. Similarly, social mathematics anxiety exhibited a weak positive correlation with psychological anxiety in teaching mathematics (*r*=0.236, *p*=0.004). This result suggested that individuals who experience higher level of social mathematics anxiety also tend to exhibit higher level of psychological anxiety when teaching mathematics. Moreover, mathematics observation anxiety revealed a moderate positive correlation with psychological anxiety in teaching mathematics (*r*=0.384, *p*=0.000). This implied that those who experience higher level of mathematics psychological anxiety are more likely to exhibit higher level of psychological anxiety in teaching mathematics. Furthermore, overall mathematics anxiety showed a moderate positive correlation with psychological anxiety in teaching mathematics (*r*=0.400, *p*=0.000). This finding indicated that individuals burdened by higher level of mathematics anxiety are also inclined to experience elevated psychological anxiety.

Table 4. Correlations among parameters of mathematics anxiety and mathematics teaching anxiety

Parameter	Behavioral anxiety	Psychological anxiety	Emotional anxiety	Overall mathematics teaching anxiety
Mathematics evaluation anxiety	0.479**	0.415**	0.294**	0.518**
Social mathematics anxiety	0.261**	0.236**	0.156	0.268**
Mathematics observation anxiety	0.405**	0.384**	0.247**	0.420**
Overall mathematics anxiety	0.444**	0.400**	0.270**	0.468**

**Correlation is significant at the 0.01 level (2-tailed).

There was a weak positive correlation between mathematics evaluation anxiety and emotional anxiety in teaching mathematics (*r*=0.294, *p*=0.000), indicating that individuals who experience higher level of mathematics evaluation anxiety are also likely to exhibit higher level of emotional anxiety. Furthermore, mathematics observation anxiety demonstrated a weak positive correlation with emotional anxiety in teaching mathematics (*r*=0.247, *p*=0.003). This suggested that individuals who experience higher level of mathematics emotional anxiety are more likely to exhibit higher level of emotional anxiety in teaching mathematics. Correspondingly, overall mathematics anxiety demonstrated a weak positive correlation with emotional anxiety in teaching mathematics (*r*=0.270, *p*=0.001), which indicates that individuals who experience higher level of mathematics anxiety are also likely to exhibit higher level of emotional anxiety. On the other hand, the results showed that there is no significant relationship between social mathematics anxiety and emotional anxiety in teaching mathematics (*r*=0.156, *p*=0.061).

A strong positive correlation was evident between mathematics evaluation anxiety and overall mathematics teaching anxiety (*r*=0.518, *p*=0.000), signifying that individuals encountering elevated levels of mathematics evaluation anxiety are also prone to experiencing heightened levels of anxiety when teaching mathematics. Similarly, social mathematics anxiety demonstrated a weak positive correlation with mathematics teaching anxiety (*r*=0.268, *p*=0.001), indicating that individuals contending with heightened levels of social mathematics anxiety also tend to display increased levels of anxiety when involved in teaching mathematics. Furthermore, mathematics observation anxiety illustrated a moderate positive correlation with overall mathematics teaching anxiety (*r*=0.420, *p*=0.000). This suggested that individuals facing heightened levels of mathematics observation anxiety are more likely to exhibit increased levels of mathematics teaching anxiety.

The findings presented in Table 4 also provided valuable insights into the relationship between the respondents' overall mathematics anxiety and overall mathematics teaching anxiety. Pearson correlations were employed to analyze this association. The results revealed a moderate positive correlation coefficient of 0.468,

accompanied by a significan *p*-value of 0.000. The positive correlation indicates a direct relationship between mathematics anxiety and mathematics teaching anxiety among the respondents. This aligned with the result in [48]. This meant that preservice teachers with higher levels of mathematics anxiety also tend to exhibit higher levels of mathematics teaching anxiety. Similarly, those with lower levels of mathematics anxiety tend to experience lower levels of mathematics teaching anxiety. Within this context, it has been found that mathematics anxiety in teachers can lead to the development of mathematics teaching anxiety [46].

3.6. Predictors of mathematics teaching anxiety

The results from the stepwise regression analysis, presented in Table 5, offered valuable insights into the factors predicting mathematics teaching anxiety. Among the various predictors considered, one factor emerged as a significant contributor to mathematics teaching anxiety: "mathematics evaluation anxiety". There was a significant positive relationship observed between mathematics evaluation anxiety and mathematics teaching anxiety (B=0.238, p<0.001). This finding suggested that individuals who experience higher levels of mathematics evaluation anxiety are more likely to exhibit higher levels of anxiety when teaching mathematics. On the other hand, individuals with lower levels of mathematics evaluation anxiety tend to have lower levels of mathematics teaching anxiety. The regression coefficient of 0.238 indicated that for every one-unit increase in "mathematics evaluation anxiety", there is an estimated increase of 0.238 units in mathematics teaching anxiety. Consequently, the regression equation can be represented as follows: Y=1.860+0.238X where the coefficient of determination is R^2=19.6%. In this equation, Y represents the estimated level of mathematics teaching anxiety, while X represents the level of "mathematics evaluation anxiety". This regression equation enables the estimation of an individual's mathematics teaching anxiety based on their level of mathematics evaluation anxiety.

The findings corroborated the assertion made in [28] that there is a connection between mathematics anxiety and mathematics teaching anxiety. Their study demonstrated a significant positive relationship between mathematics anxiety and mathematics teaching anxiety experienced by preservice teachers, with a medium effect size. Similarly, the mathematics anxiety exhibited by prospective mathematics teachers was identified as a predictor of their mathematics teaching anxiety [49]. Social mathematics anxiety and mathematics observation anxiety did not meet the criteria for inclusion in the regression model based on their *p*-values shown in Table 6. Despite their correlations with mathematics teaching anxiety, the results of the stepwise regression analysis suggested that these variables do not specifically predict the outcome variable. However, it is crucial to acknowledge that although these variables did not emerge as significant predictors in this particular analysis, they may still hold significance in other contexts or when examined with a larger sample size. The absence of significance in this analysis does not diminish the potential importance of these variables in understanding and addressing mathematics teaching anxiety.

Table 5. Predictor of mathematics teaching anxiety using Stepwise regression analysis

Predictor	*B*	*p*	*R*	R^2
Constant	1.860	0.000	0.442	0.196
Mathematics evaluation anxiety	0.238	0.000		

Table 6. Excluded variables from the regression model of mathematics teaching anxiety

Excluded variables	*B*	*p*
Social mathematics anxiety	0.024	0.787
Mathematics observation anxiety	0.181	0.054

4. CONCLUSION

The role of the teacher in the learning of mathematics holds significant importance. Several studies suggested that preservice teachers often experience heightened nervousness and difficulty concentrating during their teaching activities due to high levels of mathematics teaching anxiety. Our findings provided conclusive evidence that when preservice elementary teachers have higher levels of mathematics anxiety, they are more likely to feel more anxious when they have to teach mathematics to their future students. As a result, their confidence in their ability to effectively teach the subject may weaken, and they may feel unease and apprehension about conveying mathematical concepts to young learners. The results of this study also suggested that preservice elementary teachers who exhibit better mathematics performance are more likely to feel more at ease and capable when it comes to teaching mathematics. These findings highlighted the critical role played by the fear or apprehension related to evaluations in influencing the overall anxiety experienced by preservice elementary teachers about teaching mathematics. The fear of being judged or assessed in this context may lead to heightened self-doubt and unease, impacting their confidence in delivering effective mathematics lessons to their future students.

It is important to recognize the implications of these findings, as they emphasize the vital role that mathematics anxiety and mathematics performance play in shaping elementary preservice teachers' confidence and effectiveness in teaching mathematics. Addressing and supporting preservice teachers in managing mathematics anxiety while enhancing their mathematical proficiency can lead to more competent

and confident educators, ultimately benefiting their students' learning outcomes. Educational institutions can help alleviate anxiety and foster a positive teaching environment that promotes a love for mathematics and enhances students' mathematical abilities by providing appropriate training, resources, and emotional support during their teacher preparation programs. Future researchers interested in exploring the same topic should be aware that the findings are not generally applicable to all preservice teachers. Researchers should keep this particular focus in mind when considering the study's findings.

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AUTHOR CONTRIBUTIONS STATEMENT

The Contributor Roles Taxonomy (CRediT) below provides individual contributions of the authors to the research study.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

The research related to human use has been complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and has been approved by the Ethics Review Committee of Central Luzon State University, Philippines with ERC Code 2023-496.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [ECT], upon reasonable request.

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