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Original Research

# Determining Mathematics Anxiety Levels Among Foundation-Phase Student Teachers

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***Abstract:*** This study aims to determine mathematics anxiety among foundation-phase student teachers. The method used in this study is a quantitative research approach. Data for the study was collected using a closed questionnaire, which linked to mathematics anxiety scales adapted from Betz. Forty-seven foundation-phase mathematics student teachers participated in the study. Purposive sampling was used to select the sample for the study. Data were analyzed using descriptive statistics to determine the mathematics anxiety levels of the student teachers. The differences in anxiety levels in mathematics between male and female foundation-phase student teachers were tested using a one-sample *t*-test. The findings of the study revealed that many of the students were nervous about making a mistake anytime they were doing mathematics; half of the respondents were always worried that they did not know enough mathematics to do well in future mathematics courses. In addition, most of the student teachers had moderate mathematics anxiety, while one-third had low and very few students had high levels of mathematics anxiety. A *t*-test showed significant difference between male and female students mathematics anxiety, with female student teachers showing lower mathematics anxiety than the male student teachers. These results showed that student teachers experience varying levels of mathematics anxiety, which impacts on their understanding in mathematics and is a barrier to learning mathematics. Therefore, this study suggests that there should be an introduction of mathematics intervention such as computer software for learning mathematics which can assist and motivate the students to learn mathematics.

***Keywords:*** Mathematics Anxiety, Mathematics Performance, Foundation-phase Student Teachers, Student Mathematics Learning, Student Performance

## Introduction

Despite the fast growth of technology today, many students are pursuing careers in fields unrelated to mathematics and computation. The reason is that many students are afraid of mathematics and computation (Wahid et al. 2014). Several studies have defined mathematics anxiety in different ways. According to Bjälkebring (2019) and Skagerlund et al. (2019), mathematics anxiety is defined as a strong negative emotion toward mathematics or a feeling of tension, apprehension, or fear that interferes with mathematics performance. The emotional responses that make up mathematics anxiety result in a variety of negative effects. Mathematics anxiety causes students to experience unpleasant physiological reactions like increased heart rate or perspiration. Additionally, it causes cognitive alterations that include

negative thoughts and anxieties, as well as problems with memory and attention. Additionally, there are behavioral modifications such as a lack of enthusiasm to study mathematics and aversion to math-related courses and jobs (Beilock and Maloney 2015; Patkin and Greenstein 2020; Vukovic et al. 2013).

Skagerlund et al. (2019) state that studying mathematics is a difficult task that can be emotionally and mentally taxing. In the twenty-first century, having sufficient mathematics abilities is crucial. An individual's ability to make informed judgments regarding finances, and other matters affecting physical and mental health, might be seriously hampered by a lack of mathematical skills. Symbols for numbers and mathematics are relatively new cultural creations that are unlikely to have had time to leave genetic traces. Nonetheless both ontogenetically and phylogenetically, the capacity to express numerical magnitudes nonverbally and without the use of symbols comes before the capacity to process and manipulate symbolic numbers (Lindskog et al. 2017). Furthermore, the rapid development of technology means that society now depends on numerical skills to make educated decisions. Anxiety related to math is one element that significantly affects these abilities. According to Lindskog et al. (2017), mathematics anxiety affects students' academic performance directly and indirectly throughout their lives, influencing their decisions on their educational and professional paths.

According to Program for International Student Assessment (PISA) 2022 reports, countries with low mathematics proficiency also have high levels of mathematics anxiety. The nations with the greatest mathematics anxiety scores fell short of the Organization for Economic Cooperation and Development (OECD) average, with a mean score in mathematics of less than 400 points. Regardless of the qualities of the student or the school, mathematics anxiety is inversely correlated with mathematics achievement in every educational system. After taking into consideration the socioeconomic profile of both students and schools, an average of eighteen score points is lost in mathematics success for every one-point increase in the index of mathematics anxiety across all OECD nations (OECD 2023).

Furthermore, concerns have been expressed by TIMSS (2019) over South African students' poor mathematics performance. According to Mabena et al. (2021), the low status of mathematics and scientific literacy in the South African curriculum means that there are not enough eligible students to enroll in universities and pursue STEM fields of study. In South Africa, students' STEM proficiency has not increased to the appropriate levels. Mathematics anxiety is a major cause of poor performance for both teachers and students (Mutodi and Ngirande 2014; Verkijika and De Wet 2015; Mkhize 2019). In order to enhance students' performance in mathematics, these worries must be addressed. It is important to ascertain how students feel about mathematics. According to Scarpello (2005), many students who suffer from mathematics anxiety do not think they can solve problems mathematically as a result they abandon the subject. The contention is that students who lack confidence in

mathematics are more likely to experience significant levels of anxiety, which will negatively impact their performance in the subject. According to Kooken et al. (2013), students with strong mathematics resiliency can continue studying mathematics while facing hurdles. In contrast, students with a lower level of rehabilitation will be less persistent when learning mathematics despite barriers. Therefore, to help teacher educators teach methods that promote resilience in mathematics and to enhance the conceptual knowledge of mathematics among student teachers. An investigation into the level of mathematics anxiety experienced by student teachers at four South African universities was conducted. Research studies on mathematics anxiety among teacher candidates in Southern Africa have not been well investigated. Hence, this study aims to determine mathematics anxiety among foundation-phase student teachers. The research questions for this study are as follows:

- What are the mathematics anxiety levels of the student teachers in foundation-phase levels 3?
- Is there any significant difference in mathematics anxiety levels between male and female foundation-phase student teachers?

## Literature Review

Early in the 1950s, mathematics teachers' observations sparked interest in the topic of mathematics anxiety. Ever since, scholars have endeavored to delineate the meaning of the term "mathematics anxiety." The feeling of terror, immobility, and mental disarray that prevents one from solving mathematical problems is known as mathematics anxiety (Tobias 1980; Cipora et al. 2022). Mathematics anxiety is a tense feeling that gets in the way of manipulating numbers and figuring out mathematical issues (Richardson and Suinn 1972; Zakariya 2018). Ashcraft (2019) proposed that anxiety related to mathematics could be seen as a psychological, cognitive, sociocultural, or neurological construct. This implies that there are multiple ways to define mathematics anxiety. The psychological community has contributed significantly to the development of the idea of mathematics anxiety, mainly because of the concept's complexity and the interest it has garnered from a variety of fields, including psychology, education, and neurosciences (Buckley et al. 2016). Apart from that, studies in this area have also looked at a number of related subjects, such as its beginnings; the variables linked to mathematics anxiety, and the cognitive, affective, and behavioral aspects (Ashcraft 2002; Buckley et al. 2016).

Much of the research on mathematics anxiety focuses on student teachers (Mkhize 2019), although it affects students at other educational levels as well, including elementary (Wu et al. 2012), secondary (Taley and Ndamenenu 2022), and higher education (Lyons and Beilock 2012). According to Brown et al. (2011), however, primary school student teachers have higher levels of anxiety connected to mathematics than do other university students. Their attitudes about mathematics are typically negative (Itter and Meyers 2017). Therefore, anxiety

related to mathematics could play a role in the fact that many student teachers lack the confidence and mathematical expertise necessary to become effective math teachers (Gleason 2008; Ganley et al. 2019).

Furthermore, mathematics anxiety in student teachers was suggested to be caused by environmental, intellectual, and personal factors (Onoshakpokaiye 2023; Zanabazar et al. 2023). According to Brewster and Miller (2020), there is a possibility that student teachers' mathematics anxiety stems from their early schooling experiences, where they were not able to acquire basic mathematical ideas. Therefore, the assumption is that student teachers who do not receive mathematics intervention could develop a fear of mathematics as teachers who will be influencing the students of the future. This is because a student with poor mathematics skills becomes a teacher with poor skills in mathematics. These student teachers will, in turn, influence the coming generation of students and teachers, which will lead to a downward circle and make mathematics decline every few decades.

## Mathematics Anxiety and Student Mathematics Learning

According to research, students' anxiety about mathematics has a major negative impact on their ability to learn, which can hinder their performance in mathematics classes and limit their future opportunities to study the subject (Lau et al. 2022).

University students who were extremely concerned about mathematics shied away from majors with intermediate or high prerequisites in the subject. This suggests that a person's anxiety about mathematics may ultimately affect their choice of vocation (Geary et al. 2019). The relationship between mathematics anxiety and performance has also drawn a lot of attention due to the high average association between the two variables that meta-analysis discovered. However, studies on the connection between mathematics anxiety and mathematical cognition have made a significant contribution to the knowledge of the association between mathematics anxiety and performance (Ashcraft et al. 2022).

Furthermore, mathematics anxiety is recognized as a prevalent issue in both K–12 and postsecondary education. Many students experience anxiety because they have always found mathematics to be a challenging subject (Bates et al. 2011). Therefore, emotional factors have a big influence on mathematics learning and affect the mathematical performance of many students. According to Patkin and Greenstein (2020), several students perceive mathematics as a subject that drains their emotions, and anything related to mathematics causes them anxiety.

Moreover, student teachers lack mathematics proficiency due to negative preceding experiences in the mathematics classroom, which have long-term effects on their performances. Studies suggest that student teachers who have faced difficult mathematical learning scenarios are likely to have such experiences (Bekdemir 2010; Wilson 2013). According to Bekdemir (2010), who conducted a study involving 167 student teachers, those whose prior mathematics education was marred by unpleasant recollections and who also

showed a high level of mathematics anxiety connected their poor arithmetic abilities to unpleasant events in the past. As a result, student teachers' increased anxiety related to mathematics made it more difficult for them to learn new concepts that are essential for developing a strong understanding of mathematics content knowledge. Furthermore, Bates et al. (2011) claim that preservice teachers lacked confidence in their teaching ability. Therefore, they often discussed the lack of subject matter expertise in mathematics education. Furthermore, Ganley et al. (2019) discovered that student teachers who experience higher levels of mathematics anxiety have less knowledge about the subject to teach and more conventional views about mathematics education.

In addition, mathematics anxiety leads to a reduction in mathematical proficiency. According to Tapia and Marsh (2002), students who experience less math anxiety are more self-assured, animated, and highly motivated to master the subject. Because students can practice mathematics and solve mathematical issues in the assignments. In contrast, students who experience high levels of mathematics anxiety typically perform badly in mathematics classes. Thus, it is critical to recognize students who are experiencing extreme anxiety related to mathematics. As a result, schools should take necessary steps to reduce students' anxiety related to mathematics.

## Mathematics Anxiety and Student Performance

According to Wahid et al. (2014), mathematics anxiety led to poor performance in mathematics courses due to the negative perception associated with it. Students' academic achievement in subjects involving mathematics is impacted by this. Wahid et al. (2014) claim that students' performance is significantly influenced by their level of mathematics anxiety, meaning that a greater mathematics anxiety score is associated with a lower math performance score. Consequently, to boost students' performance in mathematics, the researchers urged educational institutions to inspire students to have self-confidence in order to enhance their mathematical ability.

Moreover, a study by Núñez-Peña et al. (2013) on "Effects of math anxiety on student success in higher education" shows that students' performance in the Research Design course, which is related to mathematics in higher education, is impacted by mathematical anxiety and negative attitudes toward the subject. Núñez-Peña et al. (2013) found that students who failed the study design course had higher levels of mathematical anxiety and poorer levels of enjoyment, motivation, and self-confidence in mathematics than those who passed. These researchers concluded that math anxiety affects university students' academic performance when they are required to take courses with a high mathematical content, in addition to the decisions and career choices made by young people today.

According to Lindskog et al. (2017), an inadequate approximate number system (ANS) raises the risk of students experiencing early failure and unfavorable learning experiences

during their mathematics education. These factors are linked to developmental ages and can have detrimental effects. According to the researchers, anxiety during learning is triggered by unpleasant environmental factors, which hinder performance and lead to avoidance behavior and increased anxiety. Furthermore, according to Lindskog et al. (2017), state-anxiety is a threat-related anxiety that correlates positively with mathematics performance and increases attentiveness through the quick start of physiological arousal reactions.

### Mathematics Anxiety and Gender Differences

Gender is a crucial aspect to consider when determining mathematics anxiety among student teachers. There is a prevalent misconception that mathematics is for men, and not for women, also called a mathematics-gender stereotype. The mathematics-gender stereotype may have an even more important role, but gender stereotypes may have little or no role to play in mathematics anxiety among university students (Rossi et al. 2022). These researchers discovered that mathematics-gender stereotypes increased mathematics anxiety in females than males. There are robust gender effects in mathematics anxiety. Research studies show that females often report higher mathematics anxiety than men in adulthood, adolescence, and primary school age (Chang and Cho 2013; Ferguson et al. 2015; Devine et al. 2012; Vukovic et al. 2013).

According to Vos et al. (2023), mathematics anxiety appeared to be a significant mediator in the relation between gender and mathematical performance. Men and women differ in mathematical performance. Vos et al. (2023) claim that the relation between gender and mathematics performance was partially mediated by mathematics anxiety and explicit gender-related stereotypes. Furthermore, Rossi et al. (2022) agree that relationship between gender-related stereotypes, mathematics anxiety and mathematics performance, indicating that the endorsement of mathematics-gender stereotypes can lead to increased mathematics anxiety, which as well affects mathematics performance.

## The Processing Efficiency Theory

Three distinct aspects of anxiety are behavior, physiological changes, and cognitive processes (Hadwin et al. 2005; Lang 2019) Anxious students' restlessness and trouble focusing are behavioral signs of anxiety that are related to their academic performance. To gain a deeper understanding of the connection between anxiety and performance, Eysenck and Calvo (1992) developed a theoretical model known as processing efficiency theory, or PET. Task performance is differentiated by PET based on efficiency and effectiveness. Task effectiveness is a function of an individual's competence, which is the degree to which their performance is evaluated using metrics for results, such as performance accuracy. Task efficiency metrics are measures of how much work a student puts in to finish a task. Extended reaction times may be a sign of performance (Elliman et al. 1997; Hadwin et al. 2005). Performance efficiency also represents

the additional effort or processing resources dedicated to a task. Therefore, greater effort should be made to maintain processing effectiveness on a hard activity, according to the Processing Efficiency Theory prediction. This means that, in comparison to low anxious students, high anxious students are expected to put in more effort to finish the activity, as shown by longer processing times, in order to maintain successful performance.

Derakshan and Eysenck (2009) assert that thinking on things unrelated to the work at hand, including worry or self-indulgence, is thought to reduce processing speed. The researchers assume that processing extraneous to the task at hand does not always negatively impact performance efficacy. According to Derakshan and Eysenck (2009), anxiety usually reduces processing efficiency more than performance effectiveness. Given that attentional control theory incorporates this aspect of processing efficiency theory. According to the Processing Efficiency Theory, a person who experiences high levels of anxiety would therefore devote greater processing capacity to a task in order to maintain or enhance performance. On an identical task, high anxiety individuals will require more processing capacity than their unanxious counterparts, which will result in less efficient work. Thus, the purpose of the study was to ascertain the degree of anxiety experienced by foundation-phase student math teachers.

## Methodology

This study aims to determine mathematics anxiety among foundation-phase student teachers. The method used in this study is quantitative research approach. Data was collected using a closed questionnaire. This study was conducted in one of the universities involved in research to assist teachers' educators in teaching methods that promote resilience in mathematics and to enhance the conceptual knowledge of mathematics among student teachers. The target participants in this study were level 3 foundation-phase mathematics student teachers.

In the South African educational system, the General Education and Training Phase (GET) is divided into three hierarchical phases: the foundation-phase, which spans from Reception to Grade 3; the Intermediate Phase, which spans from Grades 4 to 6; and the Senior Phase, which spans from Grades 7 to 9 (South Africa education info). A Bachelor of Education degree, which usually takes four years to finish, is a prerequisite for anyone wishing to work as a teacher at any level (Adelabu and Alex 2024). The foundation-phase teacher candidates were the focus of this investigation. Therefore, a Bachelor of Education degree in Foundation Phase Teaching must be eligible to teach in the foundation phase. Students enrolled in the Department of Initial Teachers Education are the foundation-phase teacher candidates.

The Foundation Phase is the first level of formal learning for learners in South Africa, ranging from Grade R to Grade 3. It is vital to lay the framework for future learning by emphasizing literacy, numeracy, and social skills. The curriculum established for the foundation phase promotes comprehensive development in children aged 5 to 9. It is designed to balance subject content acquisition and overall learning experience,

incorporating topics such as home language, first additional language (English), mathematics, and life skills.

Forty-seven level 3 foundation-phase mathematics student teachers participated in the study. The student teachers enrolled in the foundation phase of the Teaching Bachelor of Education Program are predominantly from rural secondary schools where there was low-quality teaching and learning due to the challenges faced by the schools. Teachers teach abridged curricula in rural areas due to inadequate resources and materials. Purposive sampling was used to select the participants for the study. On completion of the degree program, the student teachers will be allowed to teach mathematics in primary schools in South Africa. All the participants received a questionnaire to which they had to respond on a five-point Likert-type scale, ranging from *strongly disagree* to *strongly agree*. The questionnaire consisted of eight items linked to mathematics anxiety scales adapted from Betz (1978). The questionnaire established the level of anxiety of the student teachers. All ethical conditions were met, and the student teachers consented to participate in the study (Ethical Clearance Number: FEDSRECC014-03-23). The forty-seven foundation-phase student teachers (male = 16; female = 31) completed the questionnaire, and the data was analyzed using descriptive statistics to determine the mathematics anxiety levels of the student teachers. To examine the significance of any differences in mathematics anxiety levels between male and female foundation-phase student teachers, a one-sample *t*-test assuming equal variance was employed.

## Results

To determine the anxiety levels of the foundation-phase mathematics student teachers, a Likert-type scale questionnaire was used to collect the data. The results of the analysis were presented.

Table 1: Frequency and Percentage of Participants (Gender)

| *Gender* | *Frequency* | *Percentage* |
|---|---|---|
| Male | 16 | 34.0 |
| Female | 31 | 66.0 |

The study comprised sixteen (34%) male and thirty-one (66%) female student teachers. Descriptive statistics of student teachers on mathematics anxiety is illustrated in Table 2.

Table 2: Descriptive Statistics of Student Teachers on Mathematics Anxiety

| *Item* | *Description* | *Frequency Percentage* | | | | | *Mean* | *Standard Deviation* | *Skewness* |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | | | |
| 1 | Mathematics makes me feel uncomfortable and nervous | 6 | 27 | 4 | 8 | 2 | 2.43 | 1.058 | .894 |
| 2 | I have usually been at ease during mathematics lessons | 3 | 17 | 14 | 12 | 1 | 2.81 | .970 | .104 |
| 3 | I have usually been at ease during mathematics tests | 4 | 24 | 7 | 10 | 2 | 2.62 | 1.054 | .608 |
| 4 | My mind goes blank, and I am unable to think clearly when doing mathematics | 1 | 10 | 7 | 23 | 6 | 3.49 | 1.040 | –.516 |
| 5 | I get really uptight during mathematics tests | 3 | 17 | 12 | 15 | 0 | 2.83 | .963 | –.102 |
| 6 | I usually do not worry about my ability to solve mathematics problems | 12 | 27 | 2 | 4 | 2 | 2.09 | 1.018 | 1.374 |
| 7 | I get a sinking feeling when I think of trying hard mathematics problems | 2 | 14 | 7 | 22 | 2 | 3.17 | 1.049 | –.356 |
| 8 | I get nervous about making mistakes in math | 6 | 16 | 6 | 14 | 5 | 2.91 | 1.265 | .099 |
| | Overall Mean | | | | | | 2.48 | .511 | |

Notes: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.

Table 2 shows the frequency, mean, and standard deviation of the student teachers' responses to each item of the questionnaire. The highest mean score of the response is (*M*) = 3.49, with the standard deviation of (*SD*) = 1.040, which is the fourth item in the questionnaire and stated that "My mind goes blank, and I am unable to think clearly when doing mathematics." This indicates that many of the participants are unable to think accurately during mathematics tests or when they are solving problems in mathematics. Item seven of the questionnaire "I get a sinking feeling when I think of trying hard mathematics

problems" also recorded high mean score of (*M*) = 3.17 and *SD* = 1.049. The result indicates that several of the student teachers always feel discouraged when getting low marks in mathematics after they have done their best to have high marks. The lowest mean score is (*M*) = 2.09 and *SD* = 1.018; it is the sixth item of the questionnaire "I usually do not worry about my ability to solve mathematics problems." This indicates that few of the student teachers are not fretting about mathematics. The overall mean score of the questionnaire is 2.48 according to Table 2. This shows that only a small number of student teachers are not afraid of mathematics and many of the student teachers still need encouragement, and few are totally discouraged about mathematics. A small number of the student teachers neither agreed nor disagreed with some questionnaire statements. Fourteen student teachers neither agree that they are usually at ease during mathematics lessons nor disagree with the statement. The study's findings could not depend on the neutral option to deduce the mathematics anxiety of the student teachers. Therefore, intervention is required for those students to be able to attain a high performance in mathematics. The intervention will help improve the education of student teachers who have trouble in their mathematics classes.

Table 3: Descriptive Statistics of the Anxiety Scores and Mathematics Anxiety of Foundation-phase Student Teachers

| *Description* | *N* | *Mean* | *Median* | *Mode* | *Standard Deviation* | *Skewness* |
|---|---|---|---|---|---|---|
| Anxiety Scores | 47 | 22.34 | 22.00 | 19 | 3.818 | .258 |
| Math Anxiety | 47 | 1.85 | 2.000 | 2.00 | .6248 | .110 |

Table 3 shows the descriptive statistics of the anxiety scores and the mathematics anxiety of the student teachers. The results show that the mean score of the anxiety score is *M* = 22.34 which indicates the average anxiety score of each participant. The mean score of the math anxiety for each participant is *M* = 1.85. The anxiety score ranged from a minimum of 14 to a maximum of 32. Mathematics anxiety levels are divided into three categories: low, moderate, and high, to explain the variation in student teachers' scores. The overall mean and standard deviation were used to experimentally estimate the cut-off score for classifying the individuals into anxiety levels. The scores in the Low Mathematics Anxiety level are one which is less than the overall mean score, the scores ranging from 14 to 19. The scores in the Moderate Mathematics Anxiety level are two, which is more than the overall mean score, the scores ranging from 20 to 25. The scores in High Mathematics Anxiety level are three, which is much more than overall mean score, the scores ranging from 26 to 32. Most of the student teachers are in the Moderate Mathematics Anxiety level (59.6%), and 27.7% and 12.8% of the

student teachers in the low and high mathematics anxiety levels respectively. The frequency percentage of the participants within each category is shown in Table 4.

Table 4: Frequency Percentage of the Foundation-phase Mathematics Student Teachers Scores as a Function of Mathematics Anxiety Categories ($N$ = 47)

| *Math Anxiety Category* | *Frequency* | *Percent* | *Valid Percent* | *Cumulative Percent* | *Mean* | *Standard Deviation* |
|---|---|---|---|---|---|---|
| Low Mathematics Anxiety | 13 | 20.3 | 27.7 | 27.7 | 1.85 | .625 |
| Moderate Mathematics Anxiety | 28 | 43.8 | 59.6 | 87.2 | | |
| High Mathematics Anxiety | 6 | 9.4 | 12.8 | 100.0 | | |
| Total | 47 | 73.4 | 100.0 | | | |

The Math Anxiety levels are categorized into three which are Low, Moderate, and High anxiety. The Low anxiety category has no need of intervention, the Moderate category needs intervention and the High anxiety category will need extra effort to overcome anxiety.

Table 4 shows the math anxiety levels of the student teachers. The results illustrate that thirteen foundation-phase mathematics student teachers (27.7%) have low anxiety with mathematics anxiety of point 1.0. This indicates that the student teachers are not afraid of mathematics, and they always perform well in mathematics and have no need for intervention. Twenty-eight (59.6%) of the student teachers are on the moderate anxiety level with point 2.0 mathematics anxiety. The indication is that these student teachers need intervention to overcome the anxiety and build resilience against the anxiety. Six (12.8%) of the student teachers are on the high level of mathematics anxiety with 3.0. This indicates that the students need extra effort to be able to overcome the anxiety in mathematics.

The frequency percentage of male and female student teachers as well as one-sample *t*-test were utilized to analyze the significance of differences between the mathematics anxiety levels of the male and female foundation-phase student teachers. The frequency percentage of the male and female within each category is shown in Table 5.

Table 5: Frequency Percentage of Male and Female Student Teachers' Mathematics Anxiety Levels

| *Gender* | *N* | *Low Math Anxiety* | | *Moderate Math Anxiety* | | *High Math Anxiety* | |
|---|---|---|---|---|---|---|---|
| | | | *Percentage* | | *Percentage* | | *Percentage* |
| Male | 16 | 2 | 12 | 10 | 63 | 4 | 25 |
| Female | 31 | 11 | 35.5 | 18 | 58 | 2 | 6.5 |

Table 5 shows the frequency percentage of male and female mathematics student teachers' mathematics anxiety levels. Twelve percent of the male student teachers have low mathematics anxiety while 63% have moderate, and 25% have high mathematics anxiety. Furthermore, 35.5% of the female student teachers have low mathematics anxiety, 58% have moderate and 6.5% have high mathematics anxiety. The one-sample *t*-test was analyzed to corroborate the findings of the study.

Table 6 depicts the analysis of the one-sample *t*-test for the significant difference of the male and female mathematics anxiety levels.

Table 6: One-Sample *t*-Test

| *Group* | *N* | *Mean* | *Standard Deviation* | *t-Value* | *DF* | *p (2 Tailed)* |
|---|---|---|---|---|---|---|
| Male | 16 | 2.13 | .574 | 1.797 | 45 | .000 |
| Female | 31 | 1.74 | .588 | | | |

Notes: *t*-value significant at $p < .05$; SD, Standard Deviation; DF, Degree of Freedom.

The *t*-test findings of the significant difference in the mathematics anxiety levels between male and female foundation-phase student teachers were published in Table 6. The results demonstrated that there was a significant difference between male and female mathematics anxiety levels with $t\,(45) = 1.797$ and $p = .00 < .05$. The indication is that the difference between male and female foundation mathematics student teachers are statistically significant. The signal denotes that both male and female student teachers have mathematics anxiety; however, female students have lower anxiety than the male student teachers as shown in Tables 5 and 6. Both male and female student teachers require intervention to overcome the mathematics anxiety; however, male student teachers may need more extra effort than female student teachers.

## Discussion and Conclusion

This study investigates the mathematics anxiety levels among foundation-phase student teachers. The results revealed that a larger percentage of the student teachers were on the moderation mathematics anxiety levels; more than one-third are the low anxiety and almost one-eighth of the student teachers are at high anxiety levels. Generally, there is mathematics anxiety among the foundation-phase mathematics student teachers. The indication is that many of the student teachers are afraid of mathematics and need some encouragement to improve understanding of mathematics concepts. The result of the study agrees with other research studies (Patkin and Greenstein 2020; Mkhize 2019; Haciomeroglu 2014) that discovered mathematics anxiety among student teachers.

According to the Processing Efficiency Theory, mathematics anxiety is related to performance in mathematics. Wahid et al. (2014) claimed that mathematics anxiety led to poor performance among students. In addition, PET illustrated that high anxious students are expected to put in more effort to finish the pursuit, which take longer processing times, to maintain successful performance. Furthermore, Núñez-Peña et al. (2013) asserted that higher levels of mathematical anxiety and poorer levels of enjoyment, motivation, and self-confidence in mathematics make student teachers perform very low in mathematics (Li et al. 2021). According to Patkin and Greenstein (2020), mathematics understanding and mathematics anxiety are contrarywise to each other. Patkin and Greenstein (2020) explained that mathematics anxiety affects the student teachers' mathematical content knowledge. This means that if student teachers' mathematics anxiety is low, it will improve their knowledge of teaching concepts. On the other hand, the high mathematics anxiety will lower the mathematical knowledge of teaching of the student.

In this study, most of the student teachers have moderate mathematics anxiety. The findings of Adelabu and Alex (2022) in their study "Mathematical Knowledge for Teaching in Further Education and Training Phase: Evidence from Entry Level Student Teachers' Baseline Assessments" revealed that the mathematical content knowledge of some of the student teachers at entry level is at moderate level of achievement. In accordance with Patkin and Greenstein (2020), moderate mathematical content knowledge will result in moderate mathematics anxiety and high mathematics anxiety will diminish the student's mathematical understanding of instruction. In agreement with Patkin and Greenstein (2020), high mathematics anxiety will lower the mathematical knowledge of teaching of the student and moderate mathematical content knowledge will bring moderate mathematics anxiety. Therefore, the student teachers' moderate mathematics anxiety level may be related to their moderate understanding of mathematical concepts.

The result of this study also reveals that there is significant difference between the male and female student teachers' mathematics anxiety. The indication means male students have high anxiety than the female students, as indicated in Tables 5 and 6. That is, female student

teachers have low anxiety than the male students. Contrary to the results of this study, several other studies found that female students experience higher levels of mathematics anxiety than do male students. Devine et al. (2012), Van Mier et al. (2019), Mutodi and Ngirande (2014), Rossi et al. (2022), and Vos et al. (2023), for example, found that female students experience mathematics anxiety more than male students do as a result of their subpar performance in the subject. Szczygiel (2020) found no significant difference in mathematics anxiety between males and females.

In this study, male student teachers experienced higher levels of anxiety than females. Male students may experience higher levels of anxiety than female students due to the participants' rural and impoverished backgrounds. Male student teachers have less processing efficiency than performance effectiveness. Performance effectiveness and processing efficiency are low among male student teachers. This indicates that math is a subject that male students work on less. As a result, they lack sufficient mathematical skills, which makes the subject extremely stressful. According to Rühle (2022), in most of South Africa's provinces, female students did better than male students. These provinces, including the one where the study was carried out, have a more rural setting. Furthermore, Yu et al. (2024) found that when cultural attitudes toward females in mathematics and related fields changed, females showed greater interest in mathematics, increased influence in mathematics and engineering fields, increased self-confidence, and decreased mathematics anxiety.

In conclusion, the study revealed mathematics anxiety among the foundation-phase mathematics student teachers. Therefore, in preparing for the foundation phase, student teachers educators need to ensure that their students are mathematics-anxiety–free or low to a reasonable level so that mathematics student teachers will be able to teach mathematics concepts without any anxiety effectively. Although there has been research on math anxiety in student teachers, there is little information on math anxiety in the foundation-phase student teachers. This study is significant because it focuses on students from disadvantaged and poor backgrounds. The study assists researchers in understanding that background and environment contribute to high and low levels of anxiety. In addition, in some cases, male students may be more anxious in mathematics than female students.

## Recommendation

The study suggests that teacher educators should ensure that the student teachers are mathematics-anxiety–free so that student mathematics teachers will be able to teach mathematics concepts without anxiety. Teacher educators' qualities, such as their friendliness, approachability, and understanding of their students, also have a big role in maintaining their short-term interest in specific learning activities and improving their overall emotional experience with mathematics. Furthermore, students are less likely to experience anxiety and fear of mathematics lessons when educators demonstrate their

enthusiasm for the subject and teach them that making errors is a positive aspect of learning (Li et al. 2021). The lack of intervention programs for these student teachers limits the scope of this study. The impact of intervention programs (Relaxation and Growth Zone) on the academic performance of foundation-phase mathematics student teachers in reducing mathematics anxiety would be an intriguing area for further research. The presentation will include a range of intervention methods designed to enhance the learning experiences of student teachers who struggle with their mathematics courses. A mathematics intervention, such as Growth Zone, Relaxations, and computer software integration in mathematics class can assist and inspire students to learn mathematics. Without the pressure to do well on the final examination, the intervention will help students develop the habit of answering mathematics problems every day and gradually become proficient in the subject.

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The authors declare that generative AI or AI-assisted technologies were not used in any way to prepare, write, or complete essential authoring tasks in this article.

## Informed Consent

The authors have obtained informed consent from all participants.

## Conflict of Interest

The authors declare that there is no conflict of interest.

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